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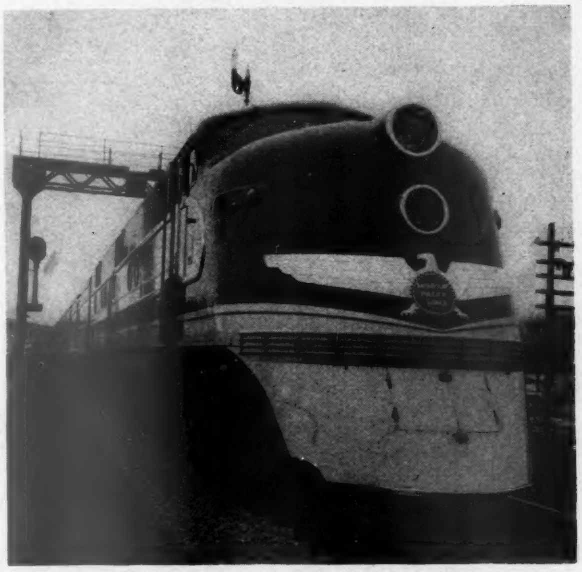

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March, 1940

Volume 114 *No. 3*

Car:

Locomotive:

General:

Editorials:

Backshop and Enginehouse:

Car Foremen and Inspectors:

BALDWIN *Diesel-Electrics*

Baldwin 660-horsepower Diesel-electric switching locomotive powered by De La Vergne, 4-cycle Diesel engine.

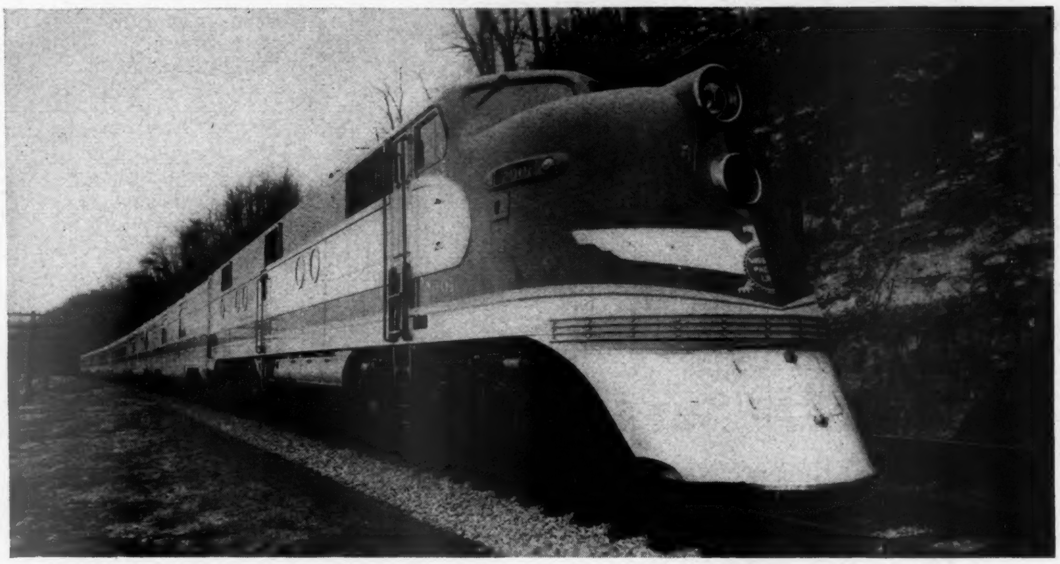
ACCESSIBILITY

● Convenient access to all parts of the power plant of Baldwin Diesel-electric switching locomotives is provided by double doors along the sides, and hatches in the top of the hood. ● All adjustments necessary to the operation of the engine can be made without dismantling any major part. ● Such accessibility makes possible—thorough inspection—saving of valuable time—low maintenance costs.

BLW THE BALDWIN GROUP

THE BALDWIN LOCOMOTIVE WORKS

Philadelphia



Aluminum Alloys Feature Construction of

Missouri Pacific Eagle Trains

Two six-car de luxe daylight trains, for service between St. Louis, Kansas City and Omaha, seat 230 persons each, weigh 596,980 lb. and are hauled by a 2,000-hp. Diesel locomotive

THE American Car and Foundry Company recently completed the construction, at its St. Charles, Mo., plant, of two six-car streamline trains for the Missouri Pacific. Strong aluminum alloys were used extensively in the construction of these trains, which are known as The Eagle, with the result that the total dry weight of the six cars, as shown in the table, represents a saving of approximately 40 per cent as compared with equivalent cars of conventional steel construction.

Each of the new Eagle trains consists of one mail-storage car, one baggage-mail car, one coach, one de luxe coach, one diner-lounge car and one parlor-observation car. The two head-end cars are 72 ft. 10 in. long and the other four cars are 84 ft. 6 in. long over the coupler pulling faces.

Each train is hauled by a 2,000-hp. Diesel-electric locomotive, built by the Electro-Motive Corporation, La Grange, Ill. The weight of each of these two locomotives is approximately 300,000 lb.

How the Cars Are Constructed

The six cars of each train, embodying the same basic shell construction, are designed to meet fully the requirements of the U. S. Railway Post Office specifications and the A. A. R. specifications for the construction of new passenger equipment. All materials used for the car-body framing are aluminum alloys with the exception of the bolsters, crossbearers and end sills, which are of low-alloy high-tensile steel, and the integral buffer castings and bolster center fillers, which are of unit cast steel, all assembled by riveting. Special extruded aluminum alloy sections are used for many of the framing members, the straightness and uniformity of these extrusions contributing largely to the true lines attained in the construction of the sides and roofs.

The center sills are of built-up aluminum alloy and have a minimum total cross-sectional area of 34.55 sq. in. The depth of the center sills is 16⅛ in. from top of cover plate to bottom of angle, and the construction includes a 15-in. by ⅜-in. top cover plate, 4-in. by 3-in. by ⅜-in. top angles, 7/16-in. webs, and 6-in. by 4-in. by 9/16-in. bottom angles. A further 5-in. by ¾-in. reinforcement is applied extending from the rear of the buffer casting through the bolster. The center-sill construction is connected at the rear of the draft gear to the combined buffer casting and draft-gear pocket, which has the coupler carrier cast integral and is arranged at the outer end to engage an anti-climber flange on the buffer face-plate angle.

The bolsters are low-alloy high-tensile steel of built-up welded construction, having a 20-in. by ⅜-in. top cover plate, 16-in by ½-in. bottom cover plates, and ¼-in. webs. Crossbearers are also of built-up welded construction, consisting of top and bottom cover plates with pressed diaphragms. The floor beams are of aluminum alloy, pressed pan shape. Underframe diagonal braces, applied from car corners to the center sill and bolster, are 7-in. aluminum alloy channels.

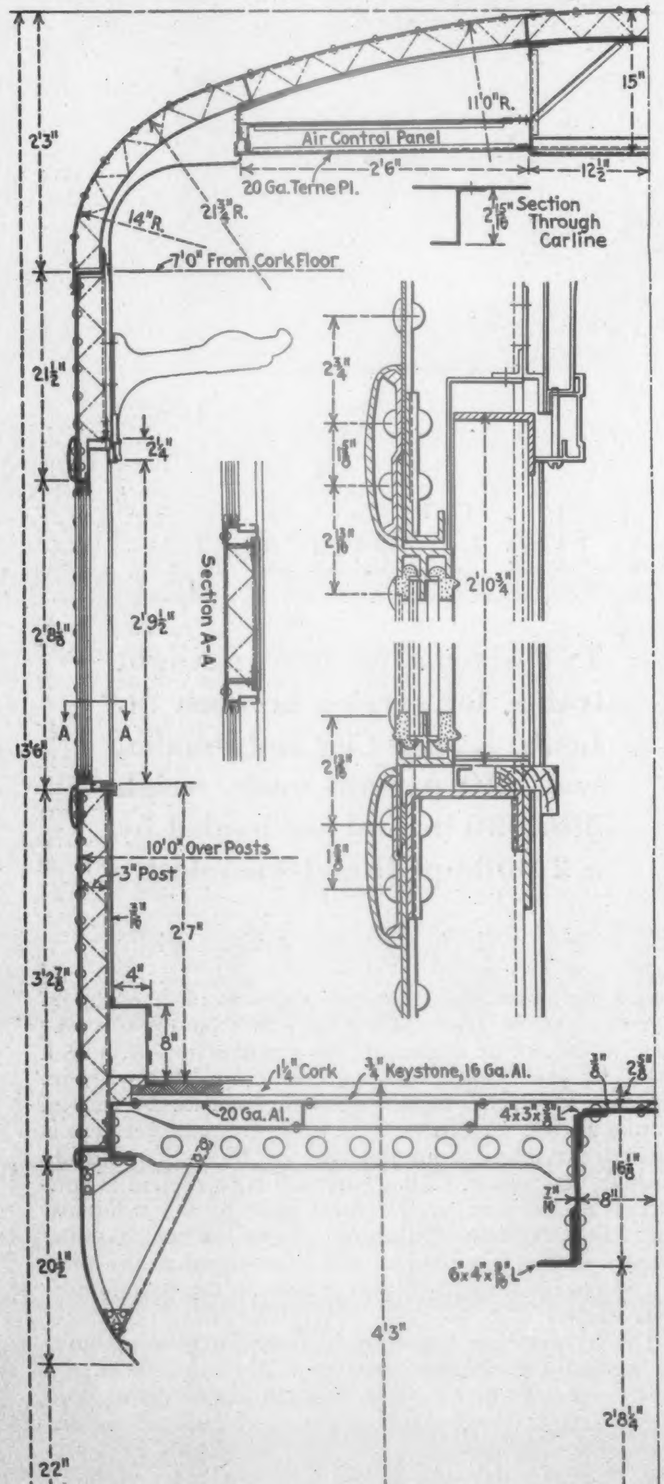
The side frames of the cars are of girder construction,

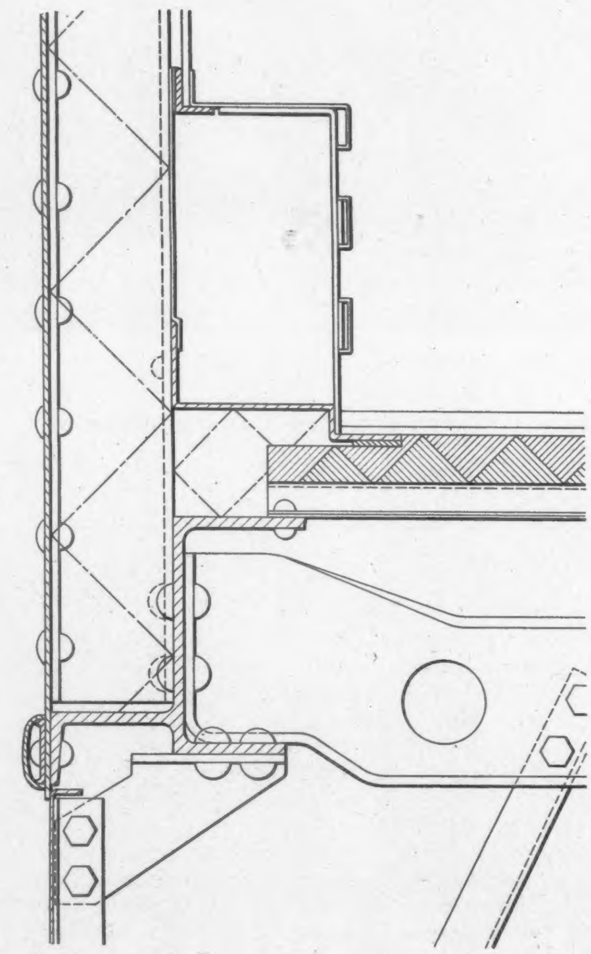
designed to carry the live and dead loads, as well as the vertical re-actions from the underframe crossmembers under buffing loads. The side sills are a special extruded aluminum section with vertical web, to which the side posts are attached, and integral flanges for supporting the floors and for attachment to underframe members and side sheets. The section is so shaped as to close completely the bottom of the side construction and absolutely exclude road dust, dirt and moisture.

The side plates are 3-in. rolled aluminum alloy Z-

Scale Weights (Lb.) of Cars for Missouri Pacific Eagle Trains

Car	Shell	Body	Trucks	Total dry wt.	Service load	Ready to run	Seating capacity
Mail-storage	21,390	46,210	38,910	85,120	230	85,350	..
Baggage-mail ...	21,210	49,490	38,450	87,940	310	88,250	..
Coach	21,880	67,410	36,650	104,060	2,100	106,160	76
De luxe coach...	22,020	67,170	37,390	104,560	2,100	106,660	61
Diner-bar-lounge .	22,110	75,420	38,120	113,540	10,300	123,840	46
Parlor-observation	21,460	64,150	37,610	101,760	2,100	103,860	47
Total	130,070	369,850	227,130	596,980	17,140	614,120	230

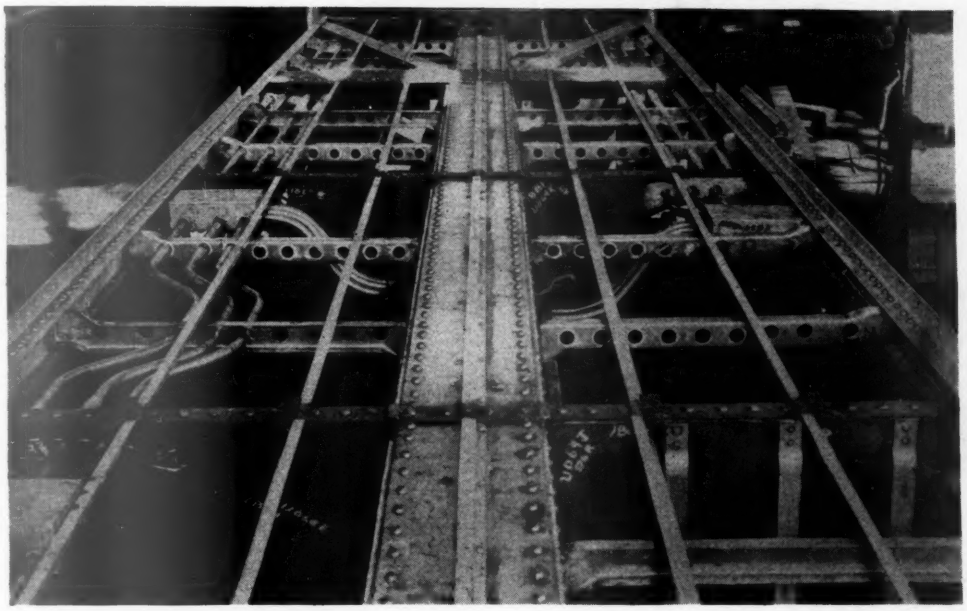




Cross-section and enlarged details of the structure of the aluminum-alloy cars of the Missouri Pacific Eagle trains

shapes, and the side posts 3-in. extruded aluminum alloy Z-shapes. The belt rail construction includes 3-in. extruded aluminum channel shapes applied between posts, with a continuous inside flat bar. An outer continuous extruded shape riveted to side posts, side sheets and belt rail channel members forms the base for the attachment of the outside 4½-in. decorative anodized aluminum snap-on molding. A similar construction is used at the top of the window openings and these two anodized moldings above and below the windows extend the full length of the train, including the locomotive.

The side sheets, letterboards and pier panels are of No. 8 B. & S. gage aluminum alloy, forming the web plate of the girder construction. These side sheets and



Left: The underframe is constructed with aluminum-alloy center sills and low-alloy, high-tensile steel cross members. Below: Details of the side and roof framing

letterboards are stiffened between posts by small extruded aluminum Z-shapes applied vertically by spot welding. The window frames are of extruded aluminum sections, the frame forming a structural part of the side girder, being riveted to side posts and to the belt rail and letterboard stiffener construction.

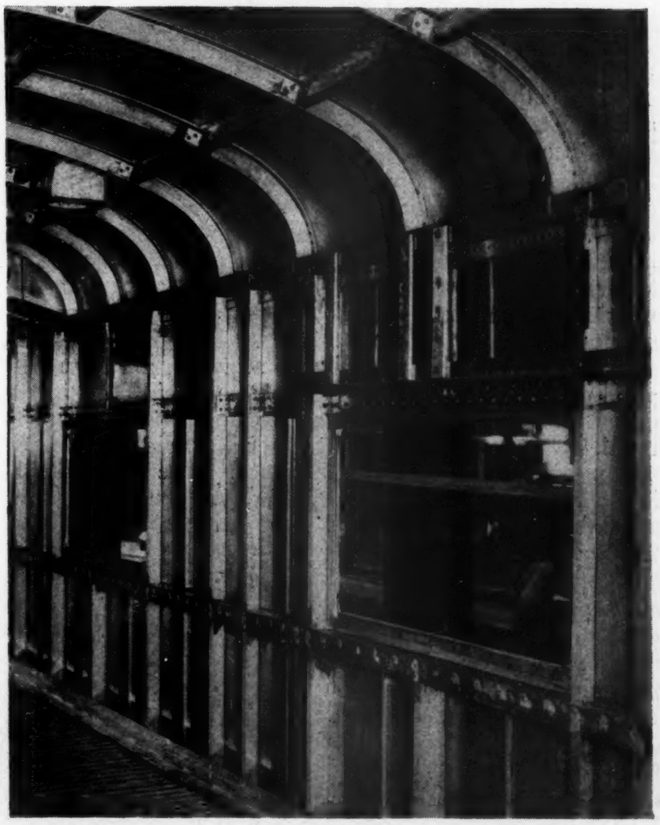
The horizontal lines of rivets in the side-frame construction are concealed by the aluminum snap-on moldings. The exposed vertical lines of side frame rivets are of aluminum, driven cold, and have a low oval head

Principal Dimensions of Eagle Cars

	Mail Storage	Comb. Mail and Baggage	Coach	De Luxe Coach	Diner-Bar-Lounge	Parlor-Obs.
Length, coupled, ft.-in.	72-10	72-10	84- 6	84- 6	84-6	84-6
Length over end sills, ft.-in. ...	70- 5¼	70- 5¼	78- 9⅝	78- 9⅝	82-1¼	...
Truck centers, ft.-in.	47-10	47-10	59- 6	59- 6	59-6	59-6
Inside width, ft.-in.	9- 6	9- 6	9- 6	9- 6	9-6	9-6
Mail room, length, ft.-in.	....	30- 3⅝	....	....	...	...
Passenger space, ft.-in.	....	....	66-11	49-11½	...	...
Dining room, length, ft.-in...	....	....	....	....	20-0	...
Lounge room, length, ft.-in...	....	....	....	....	13-5	...
Bar, length, ft.-in.	....	....	....	....	15-2⅞	...
Chair space, length, ft.-in...	....	....	....	....	...	46-0½
Observation room, length, ft.-in...	....	....	....	....	...	12-7⅜
Men's lounge, length, ft.-in...	....	....	5- 8¼	8- 0½	...	5-4½
Women's lounge, length, ft.-in...	....	....	5- 8¼	8- 2½	...	5-4½

of special design to minimize abrasion and wind resistance. The skirts, made of aluminum-alloy sheets spot-welded to stiffening supports, are applied below the side sills on all cars, being cut out at the trucks and provided with hinged or removable doors where necessary for access to underframe equipment. The battery box is built into the underframe construction, and a portion of the skirt, counterbalanced by a spring-controlled mechanism, forms the battery-box door.

The principal members of the end-frame construction are the two diaphragm posts, made of 8-in. extruded aluminum-alloy channel sections. These posts extend into pockets in the buffer castings, and are supported at



the top by the anti-telescoping construction, which consists of a 10-in. aluminum-alloy channel at the stub ends and a truss girder construction at vestibule ends, which includes the vestibule ceiling with suitable aluminum angle stiffeners. The diaphragm posts have a web thickness in the lower portion to meet fully the A. A. R. specification for shear resistance, and for weight saving the upper portion of these posts has the web thickness reduced by machining. The intermediate end posts are 4-in. by ¼-in. aluminum-alloy rolled Z-shapes and the corner posts are a special extruded aluminum section with integral flanges for the attachment of inside finish.

Mirrored panels, aluminum Venetian blinds and fluorescent lighting in side troughs and ceiling wells accentuate the attractiveness of the dining room. Below: The observation lounge at the rear end of the chair car is equipped with built-in radio, two fixed sofas and lounge chairs

Roof and Floor Construction

The roof frame is made of 3-in. aluminum alloy extruded Z-section carlines with four lines of extruded Z-section purlines. The roof sheets are .0781 in. aluminum alloy. The roof rivets are steel, driven hot, with exposed heads of a special low oval design.

The longitudinal floor stringers in the underframe construction are aluminum alloy Z-shapes supported by the underframe crossmembers. Keystone floor sheets ¾ in. high, of No. 16 B. & S. gage aluminum alloy, have the lower grooves filled with lightweight insulation, after which the false floor sheet is spot-welded to the under side of these keystone floor sheets. The keystone floor sheets with the false floor sheets attached, are then applied on top of the floor stringers, after which the upper grooves are filled with lightweight composition floor material. On top of this keystone floor is applied 1¼ in. of compressed cork, cemented in place. The upper floor in the kitchen and back of the bar are cast aluminum with an abrasive surface, and this same material is used for thresholds, buffer foot-plates and vestibule step treads.

In the two head-end cars, the floor construction includes the same false floor as in the other cars, wood floor stringers with insulation between, then double wood floors with paper between, and a third course of wood flooring applied crosswise at the baggage side doors.

The compressed cork and the materials applied in the upper and lower grooves of the keystone, constitute the floor insulation. Fiberglas insulation, secured in place by wires, is used in the sides, ends and roofs, including 3 in. thickness in the sides and 2 in. in the ends of cars, 3 in. in the roofs of passenger-carrying cars and 2 in. in the roofs of head-end cars. Anti-squeak composition cork tape is used to break the direct metallic connection between the inside finish and the car framing.

Vestibules

Both ends of all cars are equipped with sheet rubber closures, following the outside contour of the car and forming continuous lines between coupled cars and between the head-end car and the locomotive. The side section of the closure face-plate construction is hinged to the center section, which is supported by suspension rods to the car body, and face plates are held in contact by coil springs and by semi-elliptic upper buffer springs.

Inside vestibule diaphragms are used on all cars, and vestibule curtains and tail gates on passenger-carrying cars. Trap doors are of aluminum, operated in conjunction with the folding steps, which form a continuous line with side skirts when closed.

Styling of the Trains

The car equipment for the Eagle trains was styled by Raymond Loewy, industrial designer, New York. The cars are so designed that with the locomotive they appear as a unit streamline train, this effect being accentuated by the exterior color treatment. Against a background color of deep green-blue, a continuous horizontal panel runs from near the front of the locomotive to the rear end of the observation car. Accentuated by means of creamy white lines, the light gray panel is defined by two broad bands of polished aluminum. A unique window treatment, varying oblong 5-ft. wide windows with round port holes, relieves any sense of monotony.

A focal point of the exterior design appears in the emblem of the train, which is an eagle. The eagle's wide-spreading polished metal wings blend with the con-

tours of the locomotive and give emphasis to this motif as a symbol of beauty, strength and swiftness. The insignia is repeated on the rear of the observation car in full relief, sculptured in cast aluminum.

The intermediate cars between the observation car and the locomotive have straight ends to permit closing the space between the cars with rubber curtains, thus adding to the unit effect. Each car, however, is independent as far as its equipment is concerned and may be operated in any train in standard Association of American Railroads interchange traffic.

Coach Interiors

The first coach is equipped with seats for 76 passengers and behind it is a second or de luxe coach which provides seats for 61 passengers and offers the maximum in coach service. Features which lend luxury and comfort include deep pile carpeting, reclining chairs, Venetian blinds and hand-loomed curtains. The only basic difference in the two cars is that in the de luxe coach, lounge rooms are provided at either end for men and women passengers who travel longer distances.

The color scheme for the coaches has been developed in varying shades of blue, which is set off by a pale yellow ceiling. From the deep, rich blue tones of the carpet that strike the color keynote, soft, gray-blue is used for the walls above the windows and the baggage rack. The dark blue tone of the chair upholstery repeats the blue of the carpet.

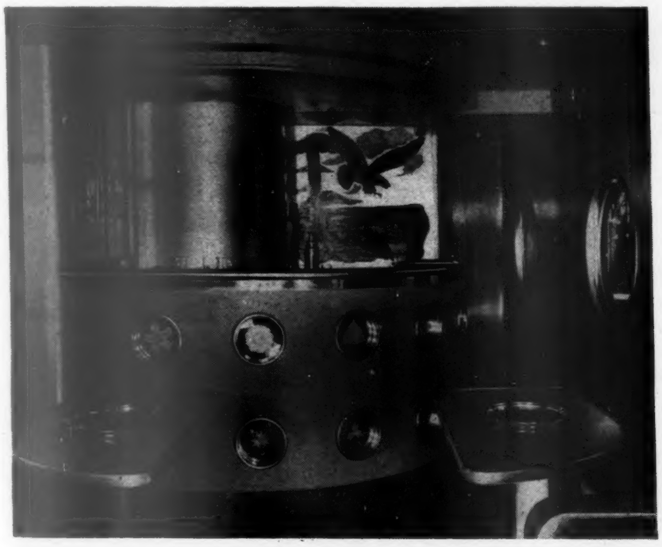
The bulkheads have been given a surface treatment that contrasts deep-blue satin-finish lacquer with a silvery tone which is carried through to the passageway. The significant motif of the eagle insignia, designed in red, gray and blue plastic, appears as an embellishment on the bulkheads. The Venetian blinds are of silver color with hand-loomed texture curtains, horizontally striped with mulberry and blue against a natural background.

For general car illumination, circular wells of light in the form of specially designed fixtures are set into the ceiling. These give direct light to the aisles and by means of circular spun-aluminum reflectors outlining the fixtures a spread of indirect light is thrown against the ceiling. In addition, there are individually controlled lighting fixtures set flush into the bottom of the baggage rack that provide direct illumination for reading.

The women's lounge has been screened with blue grass-cloth portiers that appear against the silver of the passageway. Soft pastels, such as light blue and dusty pink, are combined in charming effects. There is a sofa upholstered in a wood rose tone, flooring of pale blue rubber with off-white inlay, and a vanity dressing table of glass and aluminum. The men's lounge makes use of more masculine materials, such as knotty pine and wood panelling, pigskin upholstery, and flooring of biege with black inlay.

The Diner-Bar-Lounge Car

Beginning with the coach end of the diner-bar-lounge car is a modern kitchen completely equipped for diner service. The middle of the car is the dining compartment with tables seating 24 passengers. Separated from the dining compartment by a false partition is the bar-lounge compartment, accommodating 22 passengers and designed so that it may be used as an additional dining compartment if conditions warrant. At the rear end of the car is the bar which serves not only this car, but also the parlor-observation car which follows.



The bar at the rear end of the diner-bar-lounge car. The ceiling in this section is lower than the rest of the car and is finished in blue, with walnut on the walls. Right: The 26-chair parlor section, looking toward the stateroom end of the car. Side and ceiling lights are used effectively

Partial List of Materials and Equipment on the Missouri Pacific Streamline Trains Built by the American Car and Foundry Co.

Aluminum shapes, plates, sheets, castings, and outside snap-on moldings	Aluminum Company of America, Pittsburgh, Pa.
Quick-Lock molding	Kinkead Industries, Inc., Chicago
Steel castings	American Steel Foundries, Chicago
Cor-Ten steel	Carnegie-Illinois Steel Corp., Pittsburgh, Pa.
Truck frames, cast steel	General Steel Castings Corp., Eddystone, Pa.
Wheels (3)	Armco Railroad Sales Company, Middletown, Ohio
(3)	Bethlehem Steel Company, Bethlehem, Pa.
(3)	Carnegie-Illinois Steel Corp., Pittsburgh, Pa.
(3)	Standard Steel Works Company, Burnham, Pa.
Springs	American Locomotive Company, Railway Steel Spring Div., New York
Axles	Carnegie-Illinois Steel Corp., Pittsburgh, Pa.
Upper buffer spring	Standard Railway Equipment Mfg. Co., Chicago
Buffer castings	General Steel Castings Corporation, Eddystone, Pa.
Draft gear	Waugh Equipment Company, New York
Couplers, yokes and journal boxes	National Malleable and Steel Castings Co., Cleveland, Ohio
Coupler-centering device	American Car and Foundry Company, New York
Bolster-locking center pin	W. H. Miner, Inc., Chicago
Side bearings	Alcoma Railway Equipments, Chicago
Shock absorbers	Monroe-Evans Railway Equipment Div., Evans Products Company, Monroe, Mich.
Journal wedges	American Car and Foundry Company, New York
Journal bearings	National Bearing Metals Corp., St. Louis, Mo.
Dust guards	Railway Equipment Div., Portable Plating Company, Chicago
Roller-bearing wheel units with SKF roller bearings	American Steel Foundries, Chicago
Sound-deadening pads	United States Rubber Company, New York
Electro-pneumatic brakes	Westinghouse Air Brake Company, Wilmerding, Pa.
Simplex clasp brakes	American Steel Foundries, Chicago
Hand brakes	W. H. Miner, Inc., Chicago
Brake shoes	American Brake Shoe & Foundry Co., New York
Inside diaphragms	Tuco Products Corporation, New York
Diaphragm rubber	United States Rubber Company, New York
Vestibule curtains	The Adams & Westlake Co., Elkhart, Ind.
Vestibule face-plate lining	Scandinavia Belting Company, Newark, N. J.
Trap doors	O. M. Edwards, Inc., Syracuse, N. Y.
Threshold plates	American Abrasive Metals Company, Irvington, N. J.
Platform rubber	United States Rubber Company, New York
Weatherstrip	Midgley & Borrowdale, Chicago
Fiberglas insulation	Gustin-Bacon Manufacturing Company, Kansas City, Mo.
Doors, inside	Haskelite Manufacturing Corporation, Chicago
Doors, outside	American Car and Foundry Company, New York
Door springs	American Spiral Spring & Mfg. Co., Pittsburgh, Pa.
End door hinges	Loeffelholz Company, Milwaukee, Wis.
End door locks	Dayton Manufacturing Company, Dayton, Ohio
Locks	Yale & Towne Mfg. Co., Stamford, Conn.
Door tracks and hangers; bagg.-mail side door hangers	Richards-Wilcox Mfg. Co., Aurora, Ill.
Door closers	Norton Lasier Company, Chicago
Mail-room fixtures	American Car and Foundry Company, New York
Masonite	Masonite Corporation, Chicago
Plymetl	Haskelite Manufacturing Corporation, Chicago
Marlite	Marsh Wall Products, Inc., Dover, Ohio
Anti-squeak tape	Armstrong Cork Company, Lancaster, Pa.
Flooring	Tuco Products Corporation, New York
Keystone floor	American Car and Foundry Company, New York
Rubber floor covering	Goodyear Tire & Rubber Co., Inc., Akron, Ohio
Cork base	Armstrong Cork Company, Lancaster, Pa.
Floor cement	Presstite Engineering Company, St. Louis, Mo.
Sash, passenger-car	Hunter Sash Company, Inc., Flushing, L. I., N. Y.
Sash, baggage-mail car	O. M. Edwards, Inc., Syracuse, N. Y.
Glass	Pittsburgh Plate Glass Company, Pittsburgh, Pa.
Pressed prism safety glass	Pressed Prism Plate Glass Company, Chicago
Window-sill capping, Micarta	Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Pneu-pad	Midgley & Borrowdale, Chicago
Window curtains	The Adams & Westlake Co., Elkhart, Ind.
Venetian blinds	H. B. Dodge Company, Chicago
Tekko wall covering	Frederic Blank & Co., New York
Carved glass medallions; carved wood panels	Regal Glass Corporation, New York
Plastic emblems	Treitel-Gratz Company, New York
Display frames	Dayton Manufacturing Company, Dayton, Ohio
Formica	The Formica Insulation Company, Cincinnati, Ohio
Reclining seats	Coach & Car Equipment Co., Chicago
	S. Karpen & Bro., Inc., Chicago
Seat cushions	Firestone Tire & Rubber Co., Airtex Division, Fall River, Mass.
Parlor-car chairs	Heywood-Wakefield Company, Gardner, Mass.
Tables	General Fireproofing Company, Youngstown, Ohio
Upholstery fabrics	Blanchard Bros. & Lane, Newark, N. J.
	L. C. Chase & Co., Inc., New York
	H. D. Taylor Company, Buffalo, N. Y.
Drapery materials	Cromwell Designs, Inc., New York
	Gustin-Bacon Manufacturing Company, Kansas City, Mo.
	Morton Sundour Company, Inc., New York
	Rodoma, Inc., New York
	Rosewood Weavers, New York
	F. Schumacher & Company, New York
Carpet	Chas. P. Cochrane Company, Philadelphia, Pa.
Bars	Southern Equipment Company, St. Louis, Mo.
Bar fixtures	The Adams & Westlake Co., Elkhart, Ind.
Bar mural	Painted by Mrs. Buell Mullen, Evanston, Ill.
Clocks	A. W. Fowler Manufacturing Company, Highland, Ill.
Ash stands and serving trays	Marshall Field & Co., Chicago
Ash receivers	The Adams & Westlake Co., Elkhart, Ind.
Parcel racks	Safety Car Heating & Lighting Co., New York
Kitchen range	Stearnes Company, Chicago
Kitchen and pantry equipment	Duke Manufacturing Company, St. Louis, Mo.
Range oil burner	Williams Oil-O-Matic Heating Corp., Bloomington, Ill.
Dish washer	Surgex Manufacturing Company, Oakland, Cal.
Drinking-water cooler	General Electric, Schenectady, N. Y.
Water filters	Henry Giessel Company, Chicago
Water purifier	Tested Appliance Company, Chicago
Batteries	Edison Storage Battery Div., Thomas A. Edison, Inc., West Orange, N. J.
Charging receptacles	The Pyle-National Company, Chicago
Axle lighting equipment	Safety Car Heating & Lighting Co., New York
Lighting fixtures	The Adams & Westlake Co., Elkhart, Ind.
	Dayton Manufacturing Company, Dayton, Ohio
	Safety Car Heating & Lighting Co., New York
Fluorescent lamps	General Electric, Schenectady, N. Y.
Fluorescent starter	Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Electric wire	General Cable Corporation, New York
	Kerite Insulated Wire & Cable Co., New York
Electric conduit	Appleton Electric Company, Chicago
Cable connectors	Thomas & Betts Co., Elizabeth, N. J.
Back-up and marker lights	The Pyle-National Company, Chicago
Annunciators	Edwards & Co., Inc., Norwalk, Conn.
Motor-generator sets (for radios)	Janette Manufacturing Company, Chicago
Radios	RCA Manufacturing Company, Inc., Camden, N. J.
Air-conditioning equipment	Safety Car Heating & Lighting Co., New York
Exhaust blowers	B. F. Sturtevant Company, Hyde Park, Boston, Mass.
Mail-room fans	Safety Car Heating & Lighting Co., New York
Exhaust fans	Diehl Mfg. Co., Elizabethport, N. J.
Exhaust ventilators	American Car and Foundry Company, New York
Uni-Flo grilles	Barber-Colman Company, Rockford, Ill.
Perforated aluminum ceiling and multi-vent panels	The Pyle-National Company, Chicago
Heating equipment and air-conditioning controls	Vapor Car Heating Company, Inc., Chicago
Train connectors	The Pyle-National Company, Chicago
Dry hoppers; folding wash-stands	The Adams & Westlake Co., Elkhart, Ind.
Flush hoppers	Duner Company, Chicago
Lavatories; copper pipe and fittings	American Radiator & Standard Sanitary Co., New York
Copper pipe fittings	Mueller Brass Foundry Co., Port Huron, Mich.
Pipe insulation	Union Asbestos & Rubber Co., Chicago
Motor alternators	Safety Car Heating & Lighting Co., New York
Speed indicator	Electric Tachometer Corp., Philadelphia, Pa.
Car oil	The Texas Company, New York
Wool waste	National Waste Company, New York
Fire extinguishers	Pyrene Mfg. Co., Newark, N. J.
Decorative eagle rear of train	Aluminum Company of America, Pittsburgh, Pa.
Paint, exterior	E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.
Paint, interior	The Mitchell-Mayer Company, Inc., St. Louis, Mo.
	Murphy Varnish Company, Newark, N. J.
	Pratt & Lambert, Inc., Buffalo, N. Y.

The dining compartment is separated from the bar-lounge compartment by a swinging door, on either side of which has been set a mirror panel, etched with fruit, flower and vegetable motifs. These mirror panels are used again for decorative effect at the opposite end of the section, thus giving to the entire dining car a quality of brilliant beauty.

The ceiling, which is of silver opalescent lacquer, is curved into the bulkheads to give flowing continuity to the interior architectural and decorative effects. The soft sheen of silver is repeated in the aluminum Venetian blinds that are used for the wide windows. Above the windows is a light trough, accented with strips of translucent plastic, that runs the continuous length of the section. Fluorescent lights are set into this trough which is designed so that light is reflected downward on the tables and upward on the walls above the windows. On this wall section a new decorative fabric with a rose and silver opaline surface has been used, and the upward rays of fluorescent light highlight the beauty and reflecting quality of this luminous material. Ceiling wells of fluorescent light, shaded with large plastic sheets, are used for the general illumination of the dining section.

The general color scheme of the dining car is built around harmonious contrasts, such as gray-blue as used for the side ceiling and silver-rose for the drapery. These tones are strengthened by the deeper tone of the rose-taupe upholstery, dramatic emphasis being given by the rich claret-red of the carpet.

The bar-lounge section is divided by glass panels and achieves a club-like atmosphere with its four intimate bridge groupings in the lounge section and the inviting bar section with its friendly built-in seats. Windows in the lounge section have been grouped to make one large unit. An aluminum frame outlines the window group, with hand-loomed rough-texture curtains of blue fabric at either end. Lighting fixtures that give pleasant, glareless illumination have been set into the lowered side ceiling to throw direct rays on the bridge tables. Glass fixtures that reflect their light against spun aluminum inverted bowls provide additional illumination. Decorative wood pier panels, carved and sandblasted in oak, portray two figures of mankind, symbolic of American agriculture and industry.

At the far end of the car a curved bar predominates. Original and attractive in design, it has a facing of bright blue. Set into the blue background are 14 illuminated circles of carved glass, depicting the flowers of the states through which the Missouri Pacific lines pass. The large color mural, painted on aluminum on the back wall of the bar, symbolizes the speed and swiftness of the new streamliner as well as its emblem, the eagle.

In the bar-lounge section, the soft gray tones of the heavy pile carpet act as a foil for the yellow leather upholstery and the blue walls and draperies. Deep yellow on the side ceiling picks up the upholstery color. Plastic table tops are of pearl gray Formica to contrast with the burgundy built-in seats adjoining the bar. For the bulkheads, silver and opalescent glass at one end contrast with mirrors at the other end.

The ceiling of the bar section is lower than the lounge ceiling to give a more intimate feeling in this section. It is painted blue, in effective combination with the old Claro walnut of the walls. There are two built-in sofas, upholstered in burgundy needlepoint. Over these have been set individual lights that carry through as a panel to the vestibule. Above the sofas are port-hole windows.

Parlor-Observation Car

The parlor-observation car has men's and women's lounges at the forward end. There is a drawing room between these lounges and the passenger chair space. The observation room occupies the rear end of the car. The parlor car seats 26 persons with chairs for six additional persons in the observation room. Swivel lounge chairs, with reclining backs, together with large windows and wide window sills serve to make this a particularly comfortable and pleasant room. The lighting consists of triple-unit center fixtures and individually-controlled units at each seat.

The kitchen equipment is stainless steel

At the observation end, with its built-in radio, there are two fixed sofas and four deep-seated lounge chairs. A clock and a speedometer, designed in aluminum and plastic, decorate the wall.

The drawing room has a built-in sofa, movable chairs, built-in cabinets, and table lamps. One wall is walnut Marlite, contrasted with apple green on the other three. Reading lights above the sofa also illuminate three Currier and Ives prints of old locomotives.

Kitchen Equipment

The kitchen interior equipment is all of stainless-steel construction. The range is designed to burn oil, and ample refrigerator capacity is provided with water-ice refrigeration. An electic dish-washer is applied in one of the sinks at the side wall of the car.

Kitchen ventilation is supplied by a 1/3-hp. double exhaust blower over the range, with fresh air intake and filter in the lower part of the kitchen side door. The water-carrying capacity on the diner-bar-lounge car is 400 gal., with 300 gal. in two stainless-steel tanks under the car and 100 gal. in an overhead tank in the kitchen.

Lighting Equipment and Air-Conditioning

The two head-end cars are each provided with Safety 4-kw. underframe axle-light equipment having flat belt drive. The passenger-carrying cars have Safety 15-kw. equipment with V-belt and gear drive. Edison storage batteries of 900-amp.-hr. capacity are used on passenger-carrying cars, and 375-amp.-hr. capacity on head end cars. Lighting fixtures are all of special design. The Mazda 32-volt light load is 2,900 watts in each coach, 2,475 watts in the diner and 3,780 watts in the parlor-observa-

(*Continued on page 108*)

The Relation Between

Draft Gears and Riding Comfort

The effect of different arrangements of draft gears, buffers, and couplers on the riding qualities of passenger cars as determined from tests made by the Waugh Equipment Company

THE data obtained from an extensive series of tests conducted by the Waugh Equipment Company, New York, with a ten-car passenger train of 70-ton coaches leased from the New York Central show the relationship of draft gears to the riding comfort of passenger cars. For several years the unusual riding comfort of trains equipped with Waughmat Twin Cushions has given practical proof that these draft gears reduce or eliminate shocks and vibrations and contribute greatly to smooth riding. The tests were made to procure reliable evidence of the actual and comparative values of Waughmat Twin Cushions, friction draft gears, buffers, and other arrangements of Waughmats.

The test runs were made almost daily on the Mohawk division of the New York Central between Albany, N. Y., and Utica, a distance of 95 miles. Thirty-nine round trips were made over this district. Only the first three cars were equipped with test gears as it is obvious that a daily change of draft gears in all ten cars would have required considerable time and presented other difficulties.

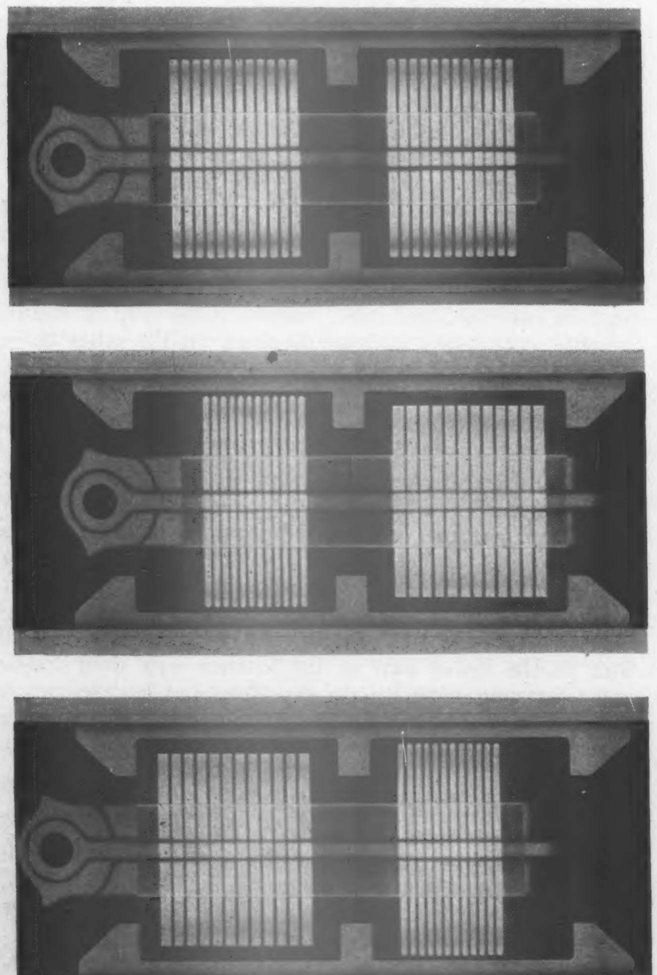


Fig. 1—The Waughmat Twin Cushion in its normal position (top), under buff with front unit compressed, rear expanded, (center), under pull with rear unit compressed, front expanded (below)

It was realized that the protection afforded by the gears in the first three cars would not be as great as might be expected if the entire train had been equipped with Twin Cushions and this fact should be kept in mind while examining the data. The remaining seven coaches were equipped with friction draft gears and remained unchanged throughout the tests. The buffers were removed from the test cars for all tests except those on the last two days and the diaphragms were pinned back so that the operation would be entirely upon the draft gears.

The equipment tested consisted of two types of well-known friction draft gears, Twin Cushions, Waughmat buffers for the last two days of tests, various arrangements of Waughmats, standard couplers, and standard couplers tightly locked by means of a rod and turnbuckles.

A friction draft gear is a mechanism capable of cushioning shocks, properly housed, which fills the space between the stops in the draft-gear pocket in its normal position. This type of gear shortens under a buffing or pulling action, and as it does so it offers frictional resistance to such action. The amount the gear shortens depends upon the load and the rate of loading. Upon reversal of the direction of motion of the car, the draft gear has to travel the distance it was previously shortened before it can again offer any resistance to buffing or pulling. The change in direction of motion is often so fast that this type of draft gear cannot respond quickly enough to prevent high shocks.

The Waughmat Twin Cushion, Fig. 1, consists of two groups of Waughmat steel-rubber springs arranged each side of the center lugs, which are attached to the car. The units are applied in such a manner that when a pulling or pushing force is delivered to the coupler, one unit is compressed, thereby absorbing the shock, while the other unit expands. When the direction of movement is changed, the expanded unit immediately absorbs the shock resulting from the change. By thus maintaining a tight connection between the coupler and the car structure and preventing open spaces at the ends, the Twin Cushion eliminates the uncontrolled movement in the connections which creates the dynamic shocks that occur so frequently in service.

Test Instruments and Procedure

As the object of these tests was to determine the effect on the cars of the various arrangements of draft gears and buffers, it was necessary to obtain permanent and continuous records of the draft-gear action. The draft-gear travel instrument, Fig. 2, was designed and built for this purpose. It was mounted directly behind the front draft-

Fig. 2—The draft-gear travel instrument in position behind the draft-gear pocket—Four strain gages may be seen on the top of the yoke

gear pocket on each of the first two cars and recorded graphically all of the movements of the yoke, even to the slightest vibrations, throughout each test run.

Referring to the illustration of the draft-gear travel instrument, the marker arm (A) was welded to the rear end of the yoke, and the marker stylus (B) recorded the yoke movements directly on the moving chart, which ran at a speed of ¼ in. per second. By means of a time recorder each second was marked automatically on the chart. A code mark corresponding to the "log of events" was marked on the graph by a marker which was controlled from a master key. Thus, it was possible to reach cause and effect conclusions regarding all draft-gear actions.

Accurate data as to the magnitudes and frequencies of longitudinal, vertical, and lateral shocks, as well as the oscillating or surging of the cars, were obtained from records produced by shock recorders. A three-way shock recorder, Fig. 3, was mounted on the floor in the center of each of the first two cars. To assure a constant chart speed the draft-gear travel instrument and the three-way shock recorders were connected to a master control board which was continuously under the observation of a member of the test crew.

The details of the three-way shock recorder are shown in the illustration. Markers (A) recorded longitudinal shocks and oscillations, (B) and (C) lateral shocks and side sway, both right and left, and (D) vertical shocks and vibrations. The chart moved at a speed of ¼ in. per second, each second being automatically recorded by means of the time marker (F). A code mark corresponding to the "log of events" was marked on the graph by means of marker (E) from the same master key and

Fig. 3—The three-way shock recorder

at the same time that the draft-gear travel instrument was marked, thus synchronizing these instruments.

A two-way shock recorder was located on the floor at each end of the first two cars. It recorded longitudinal and vertical shocks. These instruments were clock driven at a speed of 12 in. per hour so that it is easy to locate on the chart the place at which each shock occurred.

It was considered desirable to determine the magnitudes of the stresses in the draft-gear yokes and coupler shanks during the test runs from two points of view, (1) the effects of the stresses themselves, and (2) the values of the stresses as a measure or indication of the shocks to which the passengers and cars were subjected.

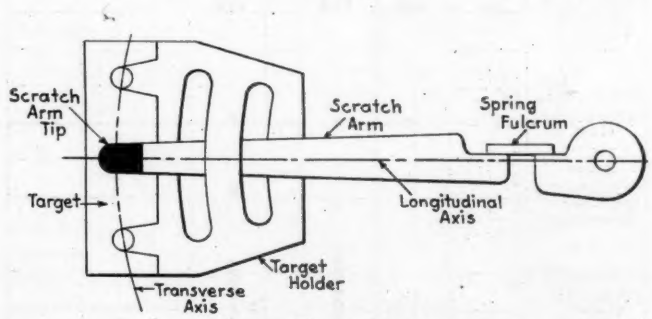
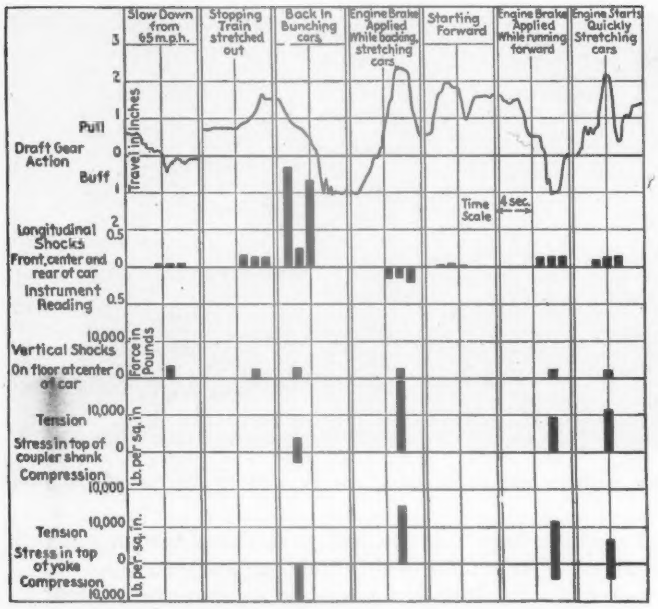


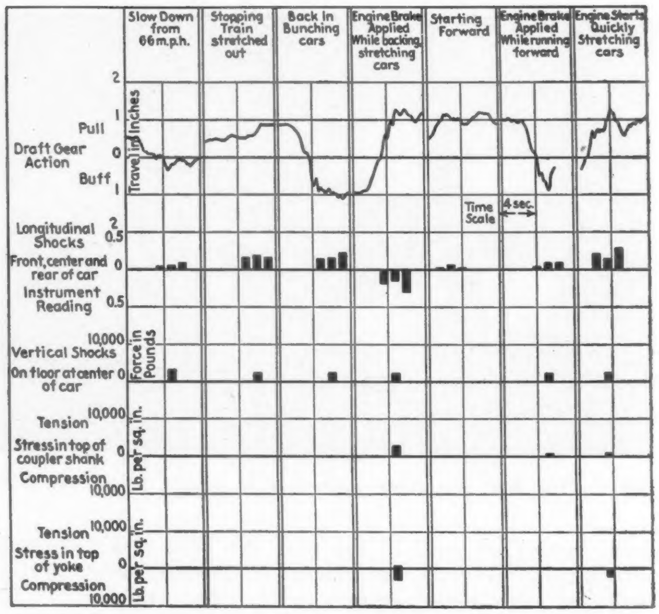
Fig. 4—The strain gage

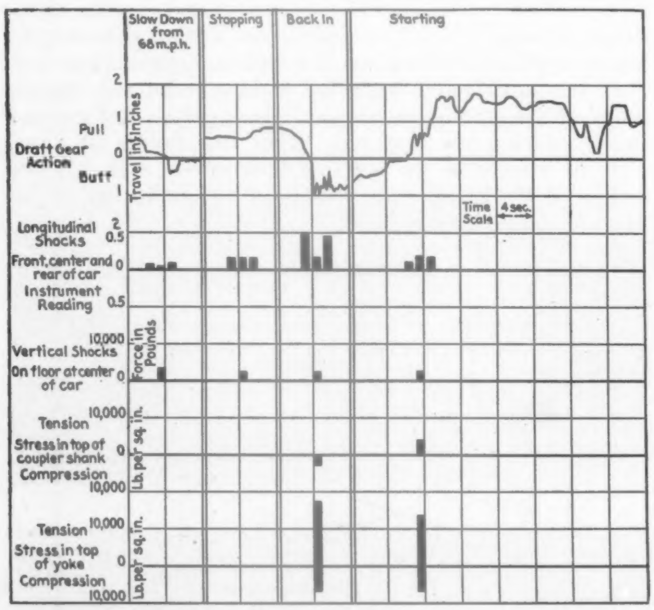
For this purpose several recording scratch strain gages were employed to determine the strains occurring in the coupler shank and the draft-gear yokes. The strain gage, Fig. 4, consists of two simple parts—a scratch arm carrying a number of diamond dust particles embedded in a matrix of cured rubber under its tip which scratch when moved, and a holder for a polished chrome plated recording surface or target on which the records of the strains are scratched.

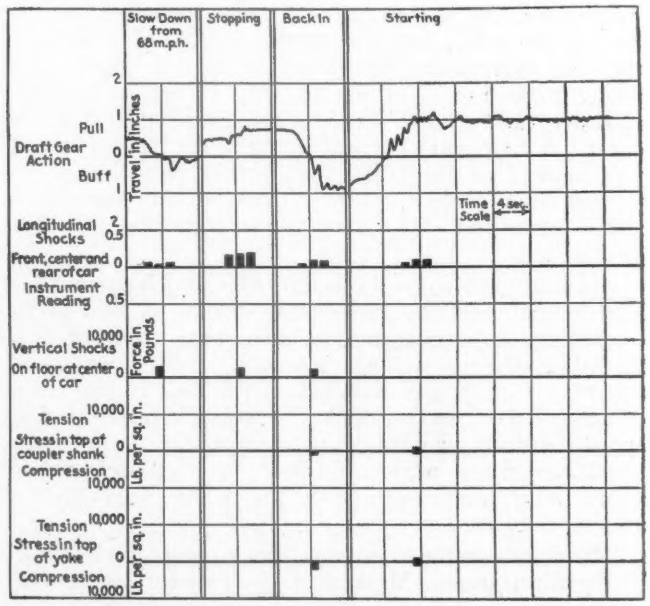
Small clamp plates containing screws were soldered to the coupler shank and the yoke at locations where it was decided to determine the strain. When a load or force was applied, a lengthening or shortening of the fibers occurred and the clamp plates were either drawn further apart or brought closer together which moved the scratch arm in the direction of the longitudinal axis of the gage an amount equal to the strain. At the same time there was a movement of the arm along the transverse axis caused by the spring tension in the arm at the lateral sliding friction being less than the static friction under the holder.

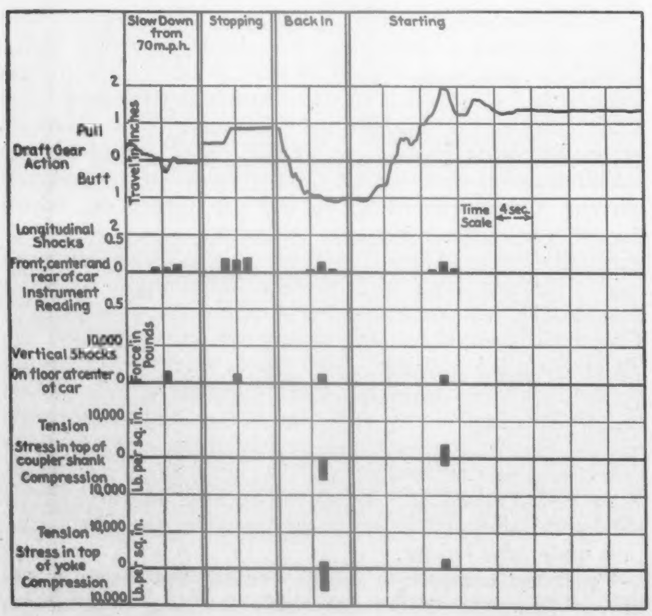
Upon the completion of the record, the target is removed from the holder for study under a microscope.

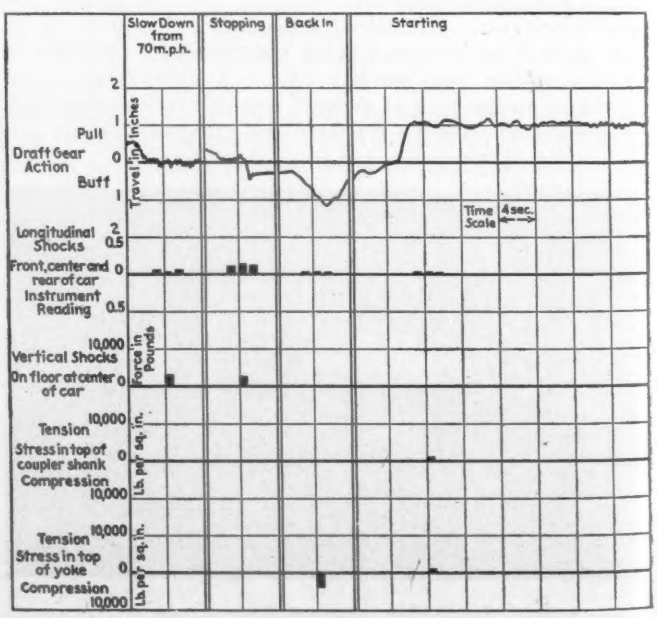

Slow Down from 65 m.p.h.
Stopping Train stretched out
Back in Bunching cars
Engine Brake Applied While backing, stretching cars
Starting Forward
Engine Brake Applied While running forward
Engine Starts Quickly Stretching cars
Pull
Draft Gear Action
Buff
Travel in Inches
Longitudinal Shocks
Front, center and rear of car
Instrument Reading
Time Scale 4 sec.
Vertical Shocks
On floor at center of car
Force in Pounds
Tension
Stress in top of coupler shank
Compression
Lb. per sq. in.
Tension
Stress in top of yoke
Compression
Lb. per sq. in.


Slow Down from 66 m.p.h.
Stopping Train stretched out
Back in Bunching cars
Engine Brake Applied While backing, stretching cars
Starting Forward
Engine Brake Applied While running forward
Engine Starts Quickly Stretching cars
Pull
Draft Gear Action
Buff
Travel in Inches
Longitudinal Shocks
Front, center and rear of car
Instrument Reading
Time Scale 4 sec.
Vertical Shocks
On floor at center of car
Force in Pounds
Tension
Stress in top of coupler shank
Compression
Lb. per sq. in.
Tension
Stress in top of yoke
Compression
Lb. per sq. in.

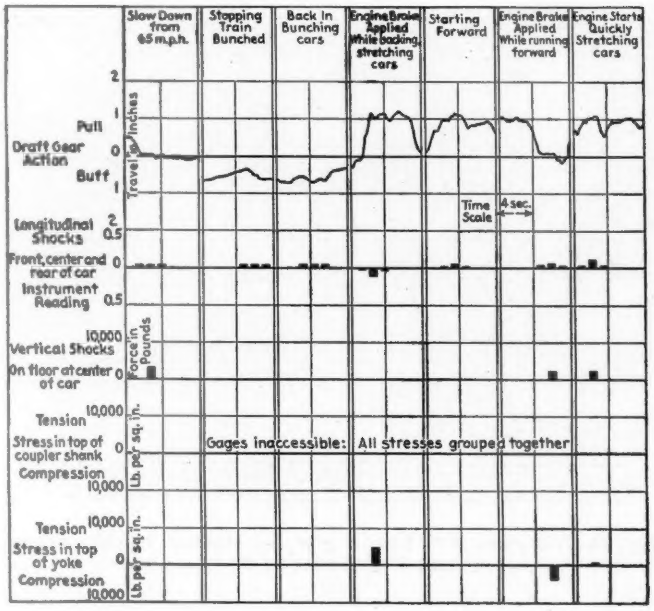

Slow Down from 68 m.p.h.
Stopping
Back In
Starting
Pull
Draft Gear Action
Buff
Travel in Inches
Longitudinal Shocks
Front, center and rear of car
Instrument Reading
Time Scale 4 sec.
Vertical Shocks
On floor at center of car
Force in Pounds
Tension
Stress in top of coupler shank
Compression
Lb. per sq. in.
Tension
Stress in top of yoke
Compression
Lb. per sq. in.


Slow Down from 68 m.p.h.
Stopping
Back In
Starting
Pull
Draft Gear Action
Buff
Travel in Inches
Longitudinal Shocks
Front, center and rear of car
Instrument Reading
Time Scale 4 sec.
Vertical Shocks
On floor at center of car
Force in Pounds
Tension
Stress in top of coupler shank
Compression
Lb. per sq. in.
Tension
Stress in top of yoke
Compression
Lb. per sq. in.


Slow Down from 70 m.p.h.
Stopping
Back In
Starting
Pull
Draft Gear Action
Buff
Travel in Inches
Longitudinal Shocks
Front, center and rear of car
Instrument Reading
Time Scale 4 sec.
Vertical Shocks
On floor at center of car
Force in Pounds
Tension
Stress in top of coupler shank
Compression
Lb. per sq. in.
Tension
Stress in top of yoke
Compression
Lb. per sq. in.


Slow Down from 70 m.p.h.
Stopping
Back In
Starting
Pull
Draft Gear Action
Buff
Travel in Inches
Longitudinal Shocks
Front, center and rear of car
Instrument Reading
Time Scale 4 sec.
Vertical Shocks
On floor at center of car
Force in Pounds
Tension
Stress in top of coupler shank
Compression
Lb. per sq. in.
Tension
Stress in top of yoke
Compression
Lb. per sq. in.

Since the abrasive tip of the marker arm carries many fine cutting particles, the target will have many duplicate records, Fig. 10, scratched upon its surface. The clearest of these is used for examination. The microscope is used to measure the scratches on either side of the base line. Knowing the gage length and the length of the scratches,



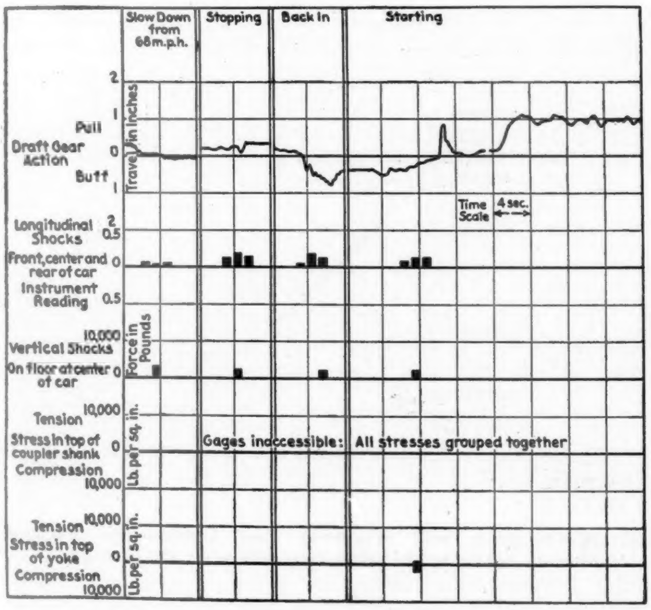
Left to right: Fig. 5A—Friction gears; Fig. 5B—Waughmat Twin Cushions; Fig. 5C—Waughmat Twin Cushions with Waughmat buffers—Al charts for normal stop and intentional rough start showing shocks and stresses in car No. 1 with standard couplers, on tangent track, 0.02 per cent grade, rails wet

the strain per inch can be determined, from which the stress in pounds per square inch is computed.

Other test equipment included stop watches, a signal system, pressure gages, telephone communication between the locomotive cab and the test cars, and a motion picture camera.

Eighteen different locations between Albany and Utica were selected at which definite events would occur such as stopping, starting, slow down, etc. These operations were performed at the same place and in the same manner by the same engine crew throughout the tests.

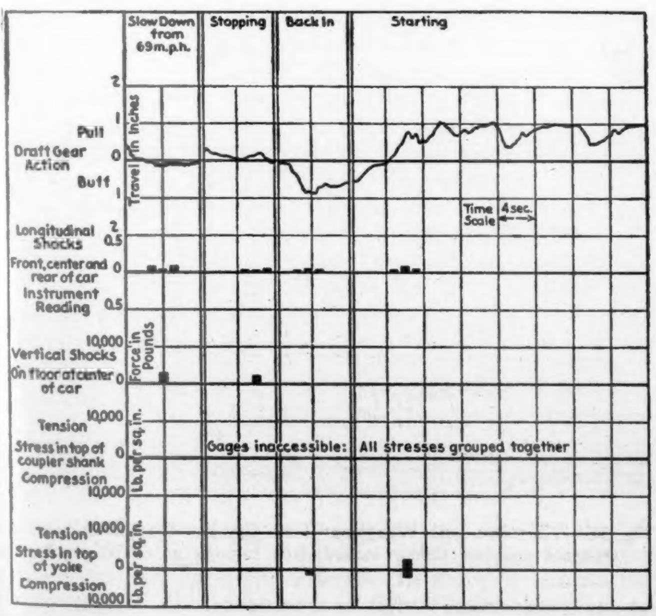
Most of the test data has been inspected and much of it has been compiled. Charts have been drawn showing



Left to right: Fig. 6A—Friction gears; Fig. 6B Waughmat Twin Cushions; Fig. 6C—Waughmat Twin Cushions with Waughmat buffers—All charts for normal stop and start showing shocks and stresses in car No. 1 with standard couplers, on curve 0 deg. 22 min. right, 0.13 per cent grade, rails wet

the draft-gear action and the accompanying shocks and stresses for friction draft gears, Twin Cushions with and without Waughmat buffers, and other arrangements, covering the entire test section of 95 miles. A few of the many charts are shown in Figs. 5 to 7.

Each of the charts has five divisions of data: (1) Draft-gear travel in inches; (2) longitudinal shocks at the front end, center, and rear end of the test car; (3) vertical shocks at the center of the test car; (4) stresses in the coupler shank, and (5) stresses in the draft-gear yoke. Each inch of chart from left to right of the draft-gear record shows four seconds of action. Having the amount of draft-gear travel, above or below the base line,



Left to right: Fig. 7A—Friction gears; Fig. 7B—Waughmat Twin Cushion; Fig. 7C—Waughmat Twin Cushions with Waughmat buffers—All charts for normal stop and start showing shocks and stresses in car No. 1 with standard couplers, tightly locked, on curve 0 deg. 22 min. right, 0.13 per cent grade, rails dry

and the time scale, the rate of travel in inches per second may easily be computed.

Fig. 5A, friction gears, shows much higher stresses than does Fig. 5B, Twin Cushions, while shocks are still lower in Fig. 5C when Waughmat buffers are added.

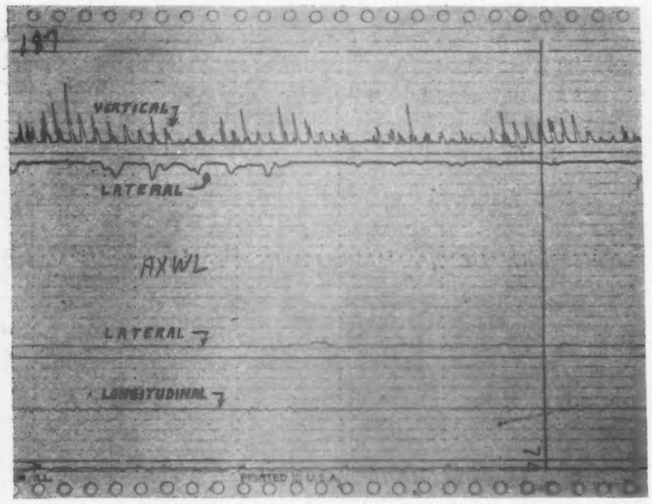


Fig. 8A—Vibrations with friction gear and standard couplers while free running at 70 m.p.h.

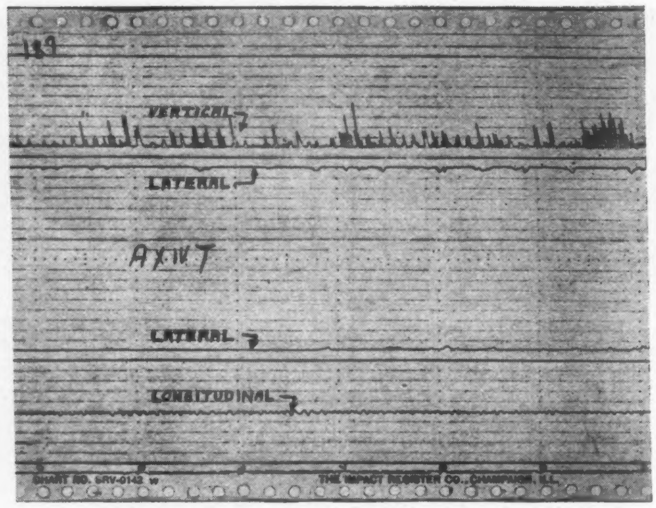


Fig. 9A—Vibrations with friction gear and standard couplers tightly locked while free running at 60-70 m.p.h.

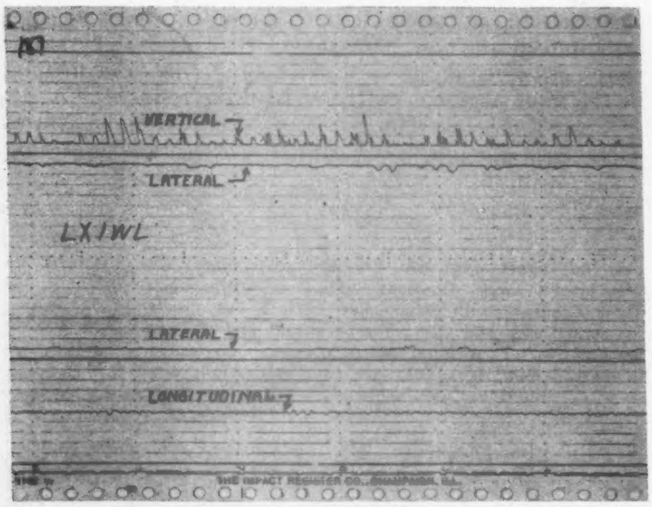


Fig. 8B—Vibrations with Waughmat Twin Cushion and standard couplers while free running at 70 m.p.h.

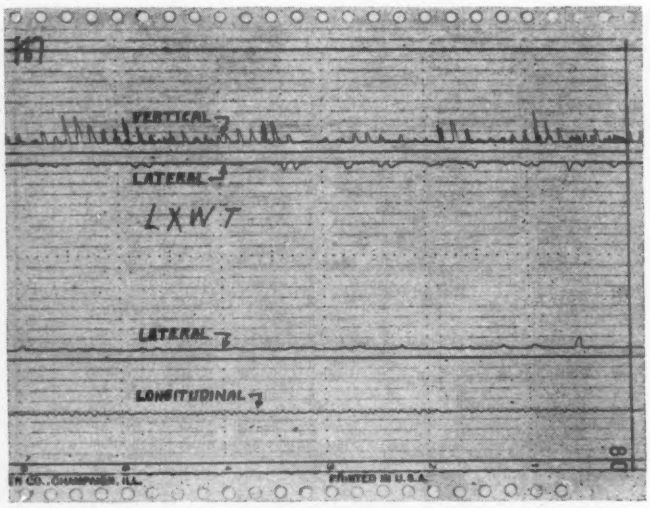


Fig. 9B—Vibrations with Waughmat Twin Cushion and standard couplers tightly locked while free running at 60-70 m.p.h.

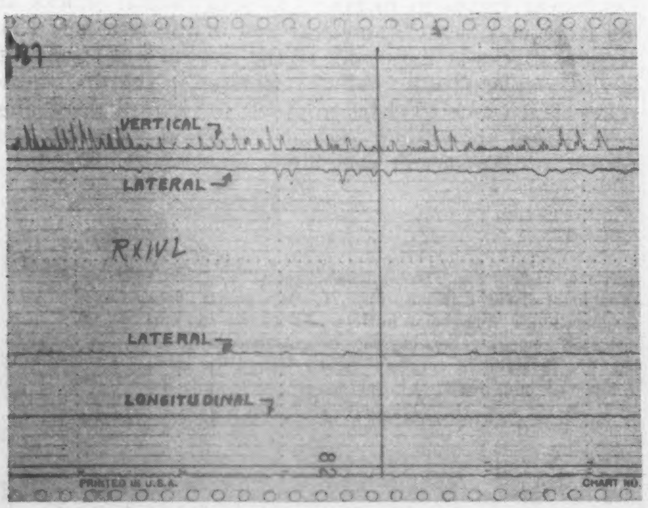


Fig. 8C—Vibrations with Waughmat Twin Cushion, Waughmat buffers, and standard couplers while free running at 70 m.p.h.

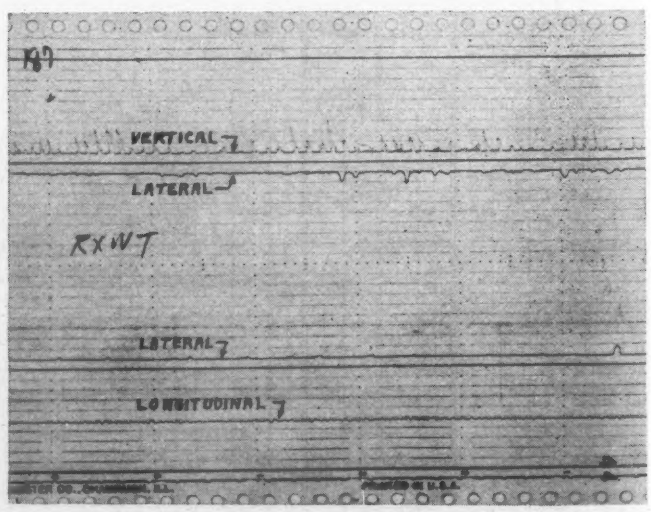


Fig. 9C—Vibrations with Waughmat Twin Cushion, Waughmat buffers, standard couplers tightly locked, free running at 60-70 m.p.h.

Figs. 8 and 9—Typical three-way recorder charts

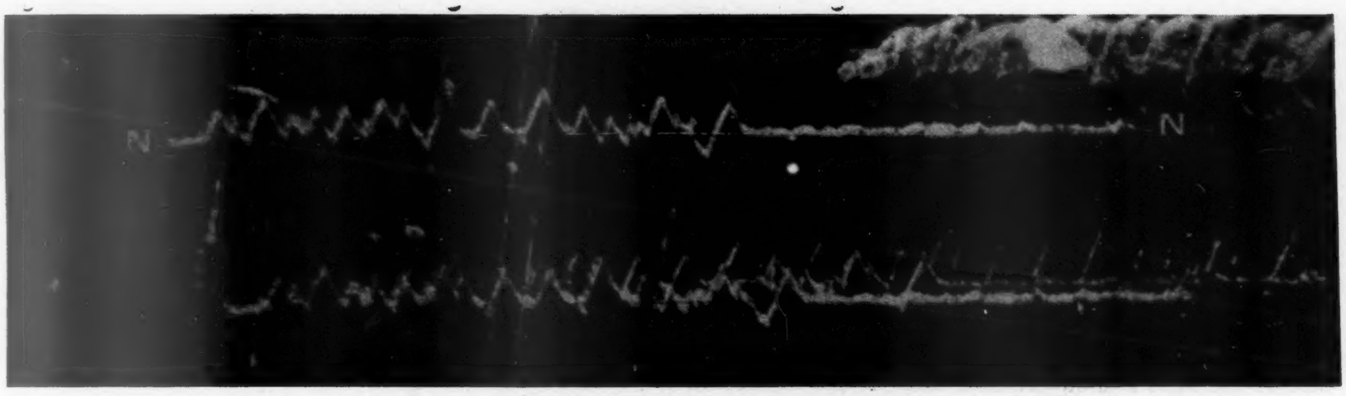


Fig. 10—Portion of typical strain-gage record magnified 300 times

Figs. 6 and 7 are graphs of action at the same location, mile post 180, the only difference being that in Fig. 6 the couplers were standard while in Fig. 7 the coupler knuckles were tightly wedged by means of a rod and turnbuckles, thus simulating tight-lock coupler effects. It is seen that there is a reduction in the magnitudes of the shocks and stresses when tightly locked couplers are employed with friction gears. A comparison of Figs. 7A and 6B with Fig. 6A shows that there is about the same amount of reduction in shocks and stresses when Twin Cushions are employed as for tightly locked couplers. In other words, Twin Cushions and tightly locked couplers perform somewhat the same function in reducing the shocks of train operations.

Train-handling operations were illustrated in Figs. 5 to 7. Records of the free running of the train are illustrated in Figs. 8 and 9. The shocks or vibrations in three directions, vertical, lateral, and longitudinal, are shown for mile post 187. Twin Cushions show much lower vertical and lateral shocks than do friction gears, Fig. 8A.

The employment of tightly locked couplers likewise reduces the magnitudes of the vertical and lateral shocks as shown by a comparison of Figs. 8A and 9A. However the frequency of vertical shocks or vibrations is slightly increased. Attention is called to the group of closely-spaced vertical vibrations of Fig. 9A. This is one of the many cases of momentary up-and-down vibrations of the car for this gear arrangement. If prolonged or repeated, it is very disturbing to the passengers. It is due to the frequency of the applied forces coinciding with the natural period of the vertical vibration of the spring system of the car. The number of vertical vibrations in the group indicated is 8.86 per second. By additional subsequent tests the natural period of vibration of this car was found to start at 8.75, to reach a maximum at about 9.27, and to be past the resonance period at 9.79 cycles per second. Hence, the natural frequency of the car and the frequency of the applied forces are seen to coincide. When the two coincide, poor or unpleasant riding is the result. For friction gears with standard couplers, Fig. 8A, the number of vibrations, or frequency, at this point on the track was only 7.50 per second. Thus, the use of tightly locked couplers increased the frequency only slightly, 7.50 to 8.86 cycles per second, but sufficiently to bring it into the range of disagreeable action. This condition can be changed either by making the spring system of the trucks slightly less stiff, or by damping the applied forces by the use of such equipment as Twin Cushions or Waughmat buffers. See Figs. 9B and 9C. Rubber, as everyone knows, is an excellent material to dampen shocks and vibrations. The advantages of tightly locked couplers are greater when used in conjunction with Twin Cushions, with or without Waughmat buffers.

Summary of Data and Conclusions

The highest shocks were found to occur when a change in the direction of the cars takes place, such as starting after having backed in. An examination of many actions illustrates the apparent reason why the rate of draft-gear action is often high for gears that can act in only one direction at a time. When the direction of travel of the car has been in one direction, the draft gear will be compressed corresponding to that condition. Upon a reversal of direction of the motion of the car, the car must move the amount the draft gear has been compressed before the gear can again offer any resistance to the energy being applied to the car. This lack of control, usual in a one-way action draft gear, results in a rapid rate of draft-gear action and consequent high shocks to the car.

The rate of travel in inches per second must be controlled. The energy applied to move the cars should be applied at a comparatively uniform rate rather than suddenly. Twin Cushions, actually two gears, do this, as is shown in the charts submitted.

Under the conditions of free running the test data show that all the various arrangements of draft gears and buffers give smooth longitudinal action. Prior to the tests it was not expected that any draft gear would greatly reduce lateral or vertical shocks. It was considered that the control of lateral shocks was more a function of equipment such as tight-lock couplers than draft gears. Similarly, it was thought that the spring system of the truck governed vertical action. However, the tests show that Twin Cushions greatly reduce both lateral and vertical shocks.

Tightly locked couplers, under the conditions of free running, greatly reduce lateral shocks, but increase the frequency of vertical shocks and vibrations.

The results of the tests suggest the following method for improving the riding qualities of passenger cars. If a car is observed to be vibrating or oscillating in any direction while running, determine the frequency of that vibration by the use of a three-way shock recorder or other instrument. Determine the natural period of vibration of the car, or one of that series of cars, in the vertical, lateral, longitudinal, and torsional planes. If the frequency during running coincides with the natural frequency of the car, commonly called resonance, change the truck spring system slightly so as to change the natural frequency or employ a damping medium such as Twin Cushions or Waughmat buffers to break up or prevent resonance. By preventing resonance, the riding qualities of the car will be improved.

A Study of

The Locomotive Boiler*

By C. A. Brandt †

The effect of the absorption efficiency, grate area, front-end design, superheater, and feed-water heating on the efficiency and capacity of the boiler

Absorption Efficiency of the Heating Surfaces

The absorption efficiency of the surfaces should be expressed as the total heat absorbed in per cent of the total heat available for absorption; that is, of the total heat drop from the furnace temperature to the metal temperature of the flues and superheater units at the smokebox. This is termed the true efficiency and is very high, about 90 per cent in a locomotive boiler, due to the high gas velocity and the cooling of the gases to within 75 deg. F. of the temperature of the water at low rating, and 200 deg. F. at high capacity.

On locomotives with Type E superheaters the smokebox gases are from 100 to 150 deg. F. lower than the steam temperature. The losses due to the sensible heat escaping in smokebox gases range from 19 to 25 per cent of the heat in the coal fired, at high rating, and the only hope of reducing these is by a radical change in the boiler design whereby the average temperature head could be increased by the use of a counterflow economizer. In this manner the smokebox gases could be lowered some 210 deg. F. which would give a 7 per cent increase in the over-all boiler efficiency.

The importance of an effective arrangement of the flue heating surfaces is most apparent at high capacity when 70 per cent of the liberated heat is delivered to the flues. The ratio of the net gas area of a flue to its gas-swept perimeter (sometimes called hydraulic depth) determines the gas-carrying capacity of the flues. The larger this ratio becomes the more gas will flow for an equal pressure drop. This has been labeled the "flue capacity factor," or *F. C. F.*

The longer a flue of a given *F. C. F.* is made, the greater becomes its true efficiency and also its draft loss. Now if the length of the flue in inches is divided by the *F. C. F.* a value is obtained which expresses the true efficiency of any diameter and length of flue. This factor has been termed the "flue efficiency factor" or *F. E. F.* The larger it becomes the more efficient a flue is. In Fig. 10 has been plotted a curve showing the true efficiency that will be obtained on any size and length of flue with a given flue efficiency factor, or *F. E. F.*; that is, the ratio of length to hydraulic depth.

In Fig. 10 is also shown the true efficiency of several sizes of flues for different lengths. The *F. E. F.* for a 2-in. inside-diameter flue 18 ft. long is 432 and gives a true efficiency of 88 per cent. If this flue is made 25 ft. long the *F. E. F.* becomes 600 and the true efficiency is increased to 94.5 per cent, but the draft loss is increased in the same ratio as the length. In America many boilers have been built with flues 22 to 25 ft. long, but usually efforts are made to keep the flue lengths down by lengthening the combustion chamber where this can be done. It is evident from Fig. 10 that a larger-diameter flue of a greater length can be used to give the same true efficiency as a smaller flue of shorter length.

* Part II of a paper presented on December 7, 1939, at the annual meeting of the American Society of Mechanical Engineers, at Philadelphia, Pa. Part I appeared in the January, 1940, issue.

† Chief engineer, The Superheater Company.

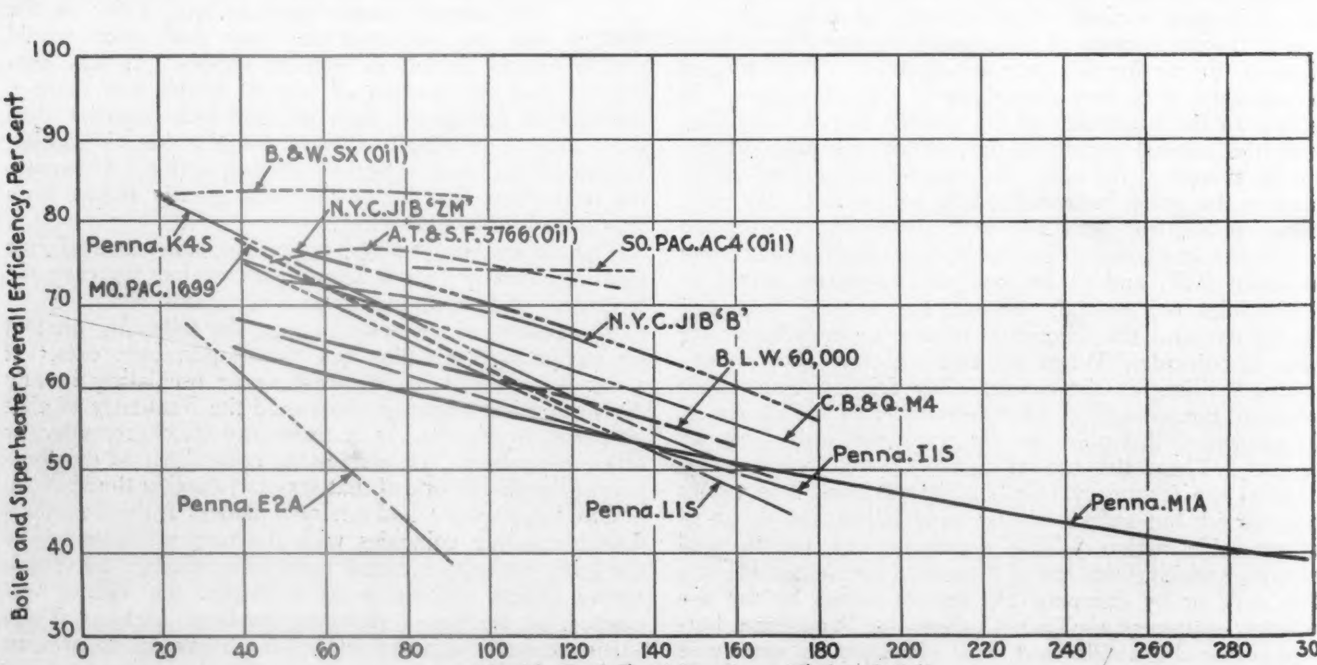


Fig. 9—Over-all boiler efficiency versus heat in fuel fired per hour

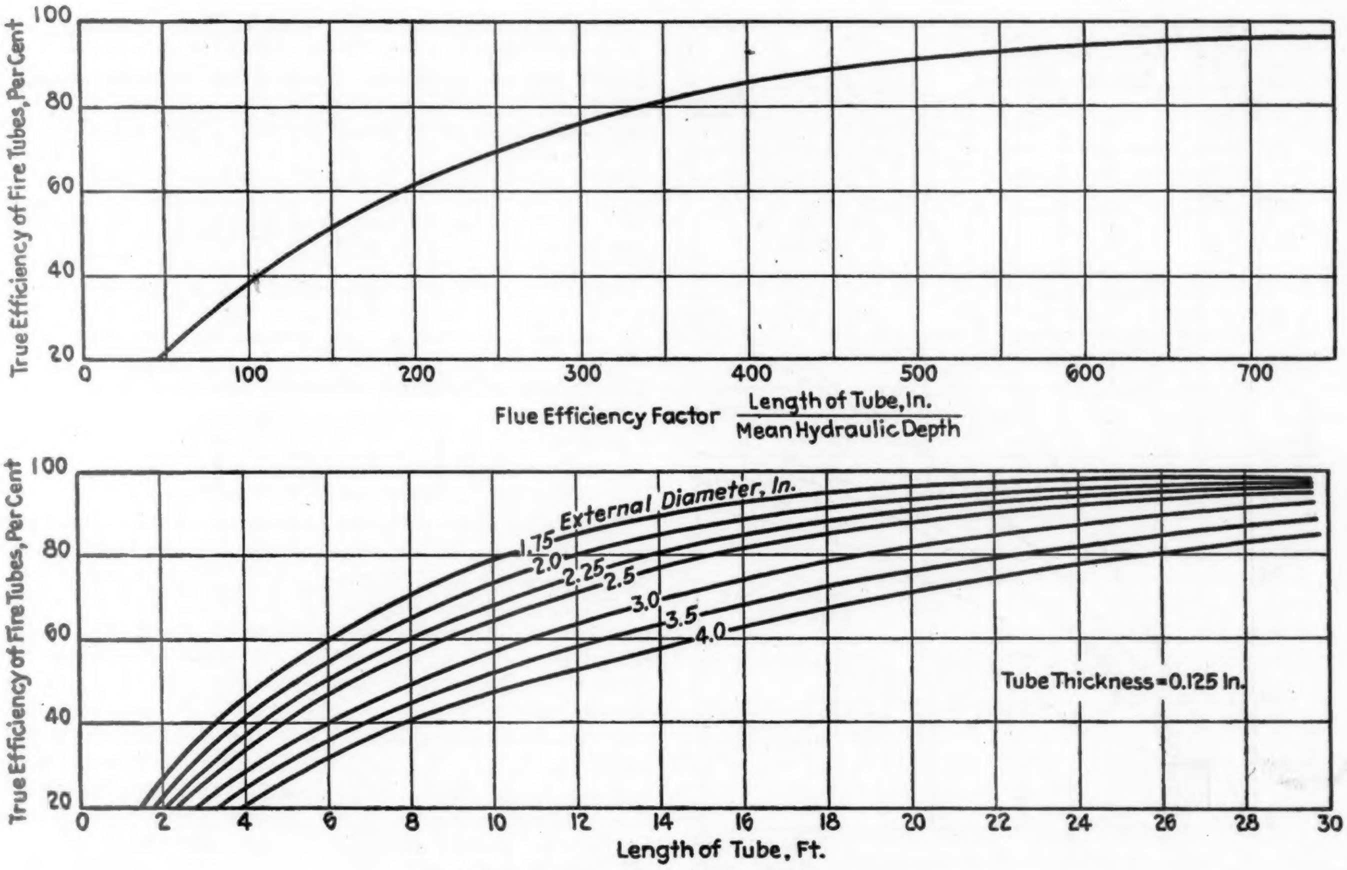


Fig. 10—True absorption efficiency of flues

The heat-absorption efficiency of locomotive boilers increases with an increase in the flue efficiency factor of the tubes and flues and ranges usually between 78 and 88 per cent. The absorption efficiency of several boilers has been shown in Fig. 11. It is noted that there is a very small decrease in this efficiency as the rate of firing is increased.

The combined absorption and combustion efficiency gives the over-all efficiency of the boiler and superheater and these data are shown in Fig. 9 for the engines previously cited. The general proportions and boiler ratios of all the engines shown in this and previous curves are given in Tables I to VI. Heat balances showing the heat absorbed by the boiler and superheater together with the various heat losses for two modern locomotives are shown in Figs. 12 and 13.

Before leaving the subject of heat absorption, a few words may be said as to the heat-absorbing capacity of the firebox. Cole proposed 55 lb. of steam generated per sq. ft. of heating surface per hour as the maximum based on Professor Goss's test at Coatesville, the only test made on a locomotive where the firebox evaporation was determined separately. This value of evaporation rate has continued to be used up to now even though the size of the locomotive firebox has increased five to six times since the Coatesville tests. It is reasonable to suppose that the same evaporation rates cannot very well apply to a firebox with 800 sq. ft. of heating surface

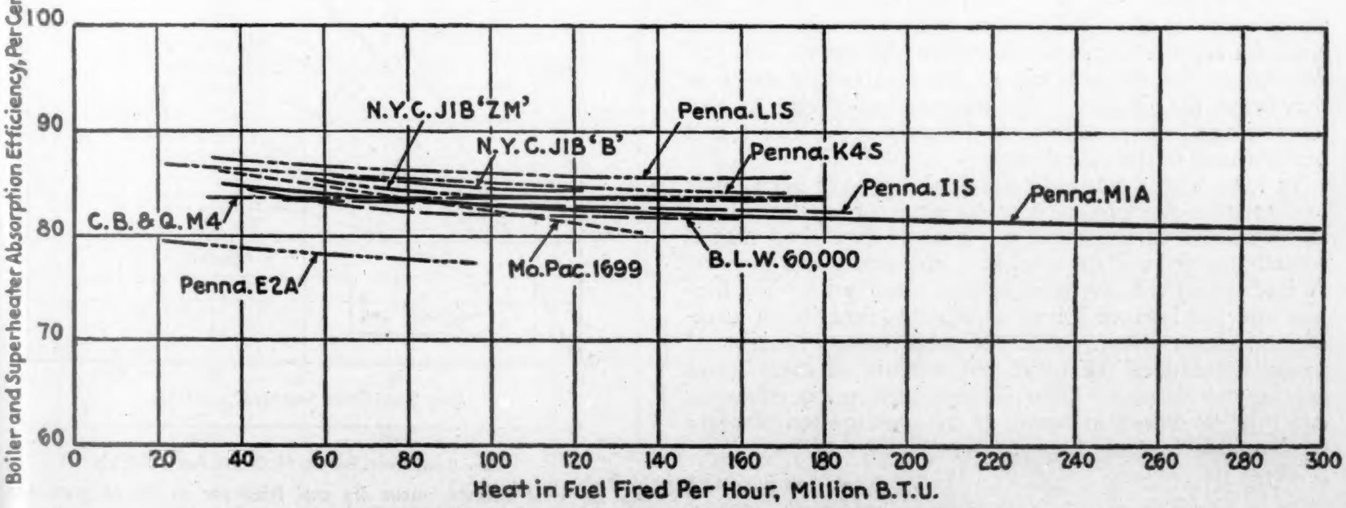


Fig. 11—Absorption efficiency versus heat in fuel fired per hour

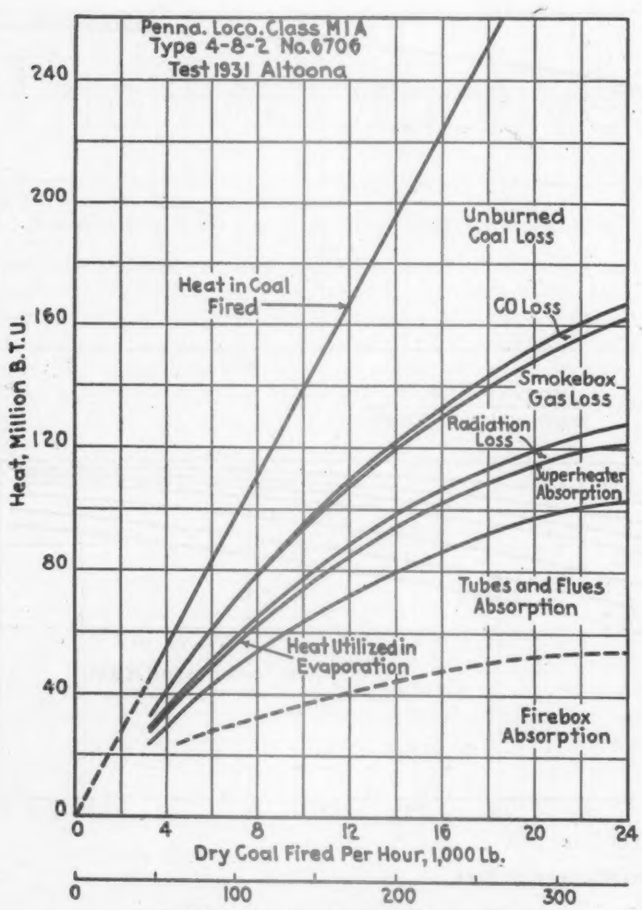


Fig. 12—Heat balance versus dry coal fired per sq. ft. of grate per hour; Pennsylvania class M1A

having syphons, circulators, etc., as to a firebox with only 150 sq. ft. of heating surface.

Since the adoption of waterwalls in stationary boilers, the heat absorption due to radiant heat has received much attention and analysis. The general behavior of radiant energy as expressed and defined in Stefan-Boltzmann's law, Prevost's law, Kirchhoff's law, Planck's formula, and studies by many other investigators, permits definition and determination of the coefficients of emission, absorption, reflection, and transmission of radiant heat. To apply these laws to locomotive fireboxes, additional test data will be required.

The proportion of the total heat liberated in the furnace, which is absorbed by the firebox heating surfaces has been termed "furnace absorption efficiency," and this determines the temperature of the combustion gases as they leave the firebox. An accurate knowledge of this temperature is important as it determines the design and performance of the superheater.

In tests where complete gas analyses have been made to determine the quantities of air used for combustion, it is possible to calculate the per cent of fuel fired that is actually burned and the total heat liberated in the furnace. A fraction of the liberated heat is absorbed by the firebox and the balance leaves as sensible heat in the combustion gases which, with the total known weight of gases, determines the mean temperature of these gases leaving the furnace. The furnace absorption efficiency can thus be stated in terms of the average temperature of the gases leaving the furnace.

Thus, if

t_1 = temperature of combustion gases leaving firebox, deg. F.

C_P = mean specific heat of combustion gases between t and 60 deg. F.

H_T = total heat liberated in firebox per lb. of combustion gases

H_g = heat in 1 lb. of combustion gas leaving furnace

H_F = heat absorbed in firebox, per cent of total liberated

then

$$H_g = C_P(t_1 - 60)$$

and the per cent of total heat liberated in the firebox that leaves the furnace in the gas is equal to

$$C_P \frac{(t_1 - 60)}{H_T} \times 100$$

The furnace absorption efficiency, therefore, is

$$H_F = \left[1 - \frac{C_P(t_1 - 60)}{H_T} \right] \times 100$$

The relation between the percentage of heat absorbed by the firebox and the temperature of gases leaving, depends upon the heat liberated per lb. of combustion gas, which again depends upon the excess air used for combustion. If, therefore, an accurate measure of the gas temperature leaving the firebox is obtained with a reliable pyrometer the furnace absorption efficiency can be determined.

It has been demonstrated that the radiation from the flames is largely due to incandescent particles of fuel and ash in the flame. The quantity and distribution of this radiating material in the flames, together with the amount of firebox heating surface, determine the coefficient of emission or absorption. This explains why boilers fired with oil give higher superheat; the less luminous flames of the oil fire will give up a smaller percentage of heat to the firebox by radiation, and the gases entering the flues are therefore hotter.

Several formulas have been proposed for the determination of the furnace absorption efficiency. The author has checked a number of the formulas proposed by Hud-

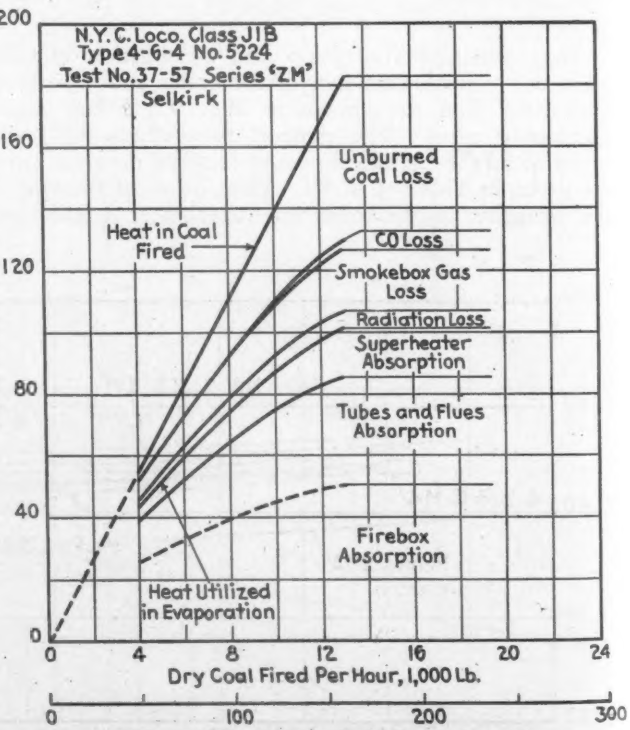


Fig. 13—Heat balance versus dry coal fired per sq. ft. of grate per hour; New York Central class J1B

son, Broido, Wohlenberg, Orrok, Munzinger, Bottomly, and Adloff, but sufficient test data are not available to conform their methods closely enough for locomotive-firebox conditions. All formulas, however, show that the fraction of the total heat liberated, which is absorbed as radiant heat by the furnace walls, decreases as the total heat liberation is increased. It will range from about 50 to 55 per cent at low rating down to perhaps 25 to 30 per cent at high-capacity operation.

At low rating the heat absorption per square foot of firebox heating surface will be near the figure commonly used, or 55 lb. of water evaporated per sq. ft. but at high capacity the heat absorption will approach a figure of 125 lb. of water per sq. ft. of heating surface. From the studies made of this problem, it is doubtful if the percentage of heat absorption can be increased to much more than 50 to 55 per cent of the heat liberated by increasing the amount of firebox heating surface, because the amount of radiant energy absorbed is limited by the effective surfaces of the fire bed and the luminosity of the flames.

Grate Area in Relation to Efficiency and Capacity

The size of the grate area should be in proportion to the maximum output expected of the boiler and the quality of the coal to be burned. With the exception of the Dakota and Wyoming lignites, the average maximum variation in the heating value of the coals mined east of the Mississippi is from 12,000 to 14,000 B. t. u. per lb., and west of the Mississippi from 10,000 to 12,000 B. t. u. per lb., or about 17 per cent for each class of coal.

If the grate-area ratios of modern locomotives, however, are studied it will be noted that they vary to a much greater extent than the heating value of the fuel, as shown in the table.

Variations in Grate-Area Ratios

	Ratio		Range of Difference, per cent
	Minimum	Maximum	
Grate area per 1,000 lb. tractive force	0.78	2.32	1:2.97
Grate area per sq. ft. total heating surface	0.0119	0.0262	1:2.20
Grate area per sq. ft. firebox heating surface	0.101	0.353	1:3.50
Grate area per sq. ft. net gas area	7.1	13.8	1:1.94

It would appear that much thought and study must be given to this subject as the proper size of grate area is important in obtaining high furnace efficiency and capacity. If too small a grate is selected, the firing rate will be too high at maximum-capacity operation and, if too large, it is difficult to keep the grate covered at low capacity, which results in bare spots, a high per cent of excess air, and a reduction of boiler efficiency and superheat. The service condition and the profile of the road must be carefully analyzed for best results.

The question of the percentage of air openings through the grates has been explored during the last few years. Recent tests on one railroad, where grates with air openings of 10, 24, and 32 per cent were tried, indicated a very small variation in boiler efficiency between the various percentages of air openings, or less than 1½ per cent above and below the mean percentage.

The relation between equivalent evaporation per square foot of grate area and coal fired per square foot of grate area per hour has been plotted in Fig. 14.

Secondary Air for Combustion

The length of the firebox and the combustion chamber is of importance, but there is a question whether the function of the latter which gives it its name is operative,

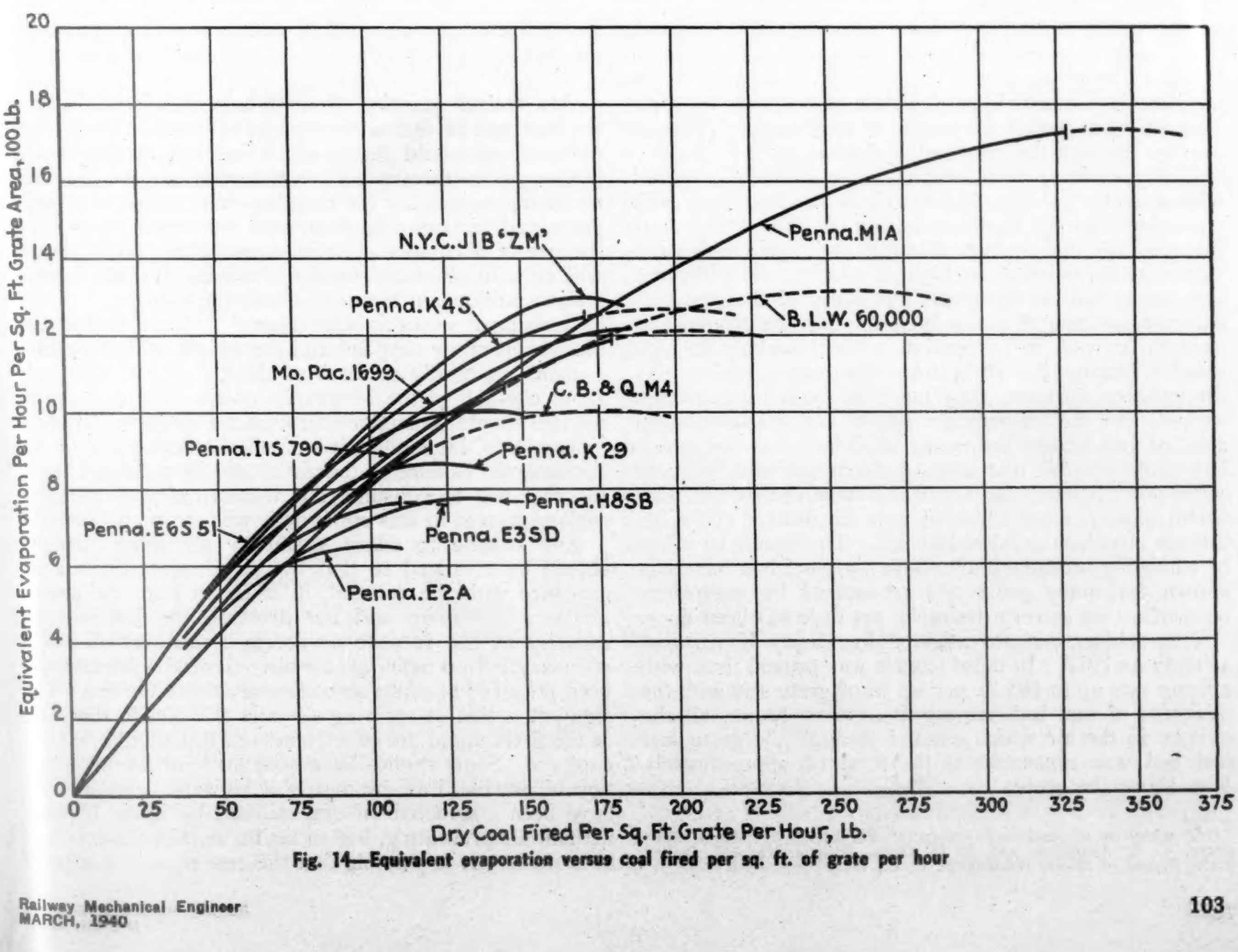


Fig. 14—Equivalent evaporation versus coal fired per sq. ft. of grate per hour

Table IV—General Dimensions and Boiler Ratios of Eight-Coupled Locomotives

1 Type	4-8-4	4-8-4	4-8-4	4-8-4	4-8-4	4-8-4	4-8-4	4-8-4	4-8-4	4-8 2
2 Railroad	D. L. & W.	C. M. St. P. & P.	C. B. & Q.	C. M. St. P. & P.	Can. Pac.	L. V.	R. F. & P.	Nor. Pac.	U. P.	P. R. R.
3 Road class	1631-1650	S1	O5	S2	K1	T3 5129	551-555	A3	800-819	M1A 6706
4 Date built	1934	1930	1938	1937	1928	1935	1936	1938	1937	1931
5 Boiler pressure, lb. per sq. in.	250	230	250	285	275	275	275	260	300	250
6 Cylinder diameter and stroke, in.	28X32	28X30	28X30	26X32	25½X30	27X30	27X30	28X31	24½X32	27X30
7 Driving wheels, diameter outside tires, in.	74	74	74	74	75	77	77	77	77	72
8 Weight on drivers, lb.	274,000	258,814	282,700	282,320	249,000	270,100	277,245	294,000	270,000	271,000
9 Total weight of engine, lb.	447,000	450,838	465,300	490,450	423,000	441,440	466,040	491,800	465,000	390,000
10 Tractive force, lb.	72,000	60,000	67,500	70,800	60,800	66,500	66,500	69,800	63,600	64,550
11 Boiler diameter, first course, inside, in.	84¼	86⅝	86½	90⅝	82½	84⅝	86	86⅜	86⅝	82
12 Boiler diameter, largest, outside, in.	95	100	100	100	96½	98¼	98¼	99	100	96
13 Length over tube sheets, ft.-in.	21-6	21-0	21-0	21-0	20-6	21-6	21-0	19-6	20-6	19-1
14 Combustion-chamber length, in.	66⅛	60	40	72	60	48	78	90½	72	98
15 Grate area, sq. ft.	88.2	103.0	106.5	106.0	93.5	96.5	96.3	115.0	100.2	70
16 Tube and flue heating surface, sq. ft.*	4,992	4,860	4,804	4,931	4,509	4,932	4,827	4,202	4,118	4,303
17 Firebox heating surface, sq. ft.*	496	540	433	578	422	507	551	553	479	403
18 Total evaporative heating surface, sq. ft.*	5,488	5,400	5,237	5,509	4,931	5,439	5,378	4,755	4,597	4,706
19 Superheater surface, steam side, sq. ft.	2,180	2,403	2,300	2,236	2,112	2,056	2,130	2,026	1,458	1,630
20 Firebox volume, cu. ft.	534	630	650	700	620	540	640	812	675	475
21 Gas area through boiler, sq. ft.	10.20	10.30	10.15	11.10	9.86	10.05	10.05	10.18	9.67	9.71
22 Type of superheater	E	E	E	E	E	E	E	E	A	E
23 Steam area through superheater, sq. in.	67.7	76.9	72.4	77.3	69.0	67.7	69.1	75.3	66.0	56.4
24 Maximum evaporation, calculated, lb. per hr.	76,905	79,050	72,160	82,000	69,140	76,990	79,385	75,280	68,700	67,850
25 Maximum evaporation, on test, lb. per hr.	....	....	....	....	....	....	....	....	....	99,095
26 Flues, number and diameter, in.	202-3½	218-3½	218-3½	201-3¾	196-3½ 59-2¼	202-3½	205-3½	186-3¾	58-5½	170-3½
27 Tubes, number and diameter, in.	82-2¼	56-2¼	51-2¼	66-2¼	7-3½	77-2¼	73-2¼	58-2¼	201-2¼	120-2¼
28 Superheater units, number and diameter, in.	102-1⅜	109-1⅜	109-1⅜	102-1¼	98-1⅜	102-1⅜	104-1⅜	94-1¼	58-1½	85-1⅜
29 Gas area per 1,000 lb. tractive force, sq. ft.	.142	.172	.151	.157	.162	.151	.151	.145	.152	.151
30 Gas area per sq. ft. of grate, sq. ft.	.115	.100	.095	.105	.105	.104	.104	.089	.097	.139
31 Gas area per sq. ft. of tube and flue heating surface, sq. ft.	.00204	.00212	.00211	.00225	.00219	.00204	.00208	.00242	.00235	.00226
32 Grate per 1,000 lb. tractive force, sq. ft.	1.23	1.72	1.58	1.50	1.54	1.45	1.45	1.65	1.58	1.09
33 Grate per sq. ft. total evaporative heating surface, sq. ft.	.0161	.0191	.0204	.0192	.0190	.0177	.0179	.0242	.0218	.0149
34 Firebox volume per 1,000 lb. tractive force, cu. ft.	7.42	10.50	9.63	9.90	10.20	8.12	9.63	11.67	10.60	7.35
35 Firebox volume per sq. ft. of gas area, cu. ft.	52.4	61.1	64.0	63.1	62.8	53.8	63.7	79.5	69.8	49.0
36 Firebox volume per sq. ft. of grate, cu. ft.	6.05	6.11	6.10	6.60	6.63	5.60	6.67	7.06	6.75	6.80
37 Firebox volume per sq. ft. total evaporative heating surface, cu. ft.	97.2	116.0	124.0	127.1	126.0	99.3	119.0	171.0	147.0	101.0
38 Firebox heating surface per sq. ft. of grate, sq. ft.	5.64	5.24	4.06	5.46	4.52	5.26	5.72	4.80	4.79	5.75
39 Firebox heating surface per sq. ft. total evap. heating surface x 100 sq. ft.	9.03	10.00	8.27	10.50	8.56	9.34	10.25	11.60	10.42	8.55
40 Total evap. heating surface per 1,000 lb. tractive force, sq. ft.	76.2	90.0	77.5	77.8	81.1	81.6	81.0	68.1	72.3	72.8
41 Total evap. heating surface per sq. ft. of grate, sq. ft.	62.2	52.4	49.2	52.0	52.7	56.4	56.0	41.4	46.0	67.2
42 Superheat. surface per sq. ft. total evap. heat. surface, sq. ft.	.398	.445	.440	.406	.427	.378	.396	.422	.317	.346
43 Gas area through flues, per cent	82.2	88.0	89.2	87.0	82.8	83.2	84.0	87.8	55.5	73.0
44 Weight on drivers per 1,000 lb. tractive force, lb.	3,800	4,315	4,185	3,990	4,090	4,065	4,170	4,220	4,250	4,200
45 Total weight of engine per 1,000 lb. tractive force, lb.	6,210	7,515	6,890	6,930	6,960	6,650	7,010	7,040	7,320	6,040

*Water side.

as there is no air admitted ahead of the arch on most locomotives to permit the carbon to burn completely in its passage through the combustion chamber.

Today, most modern locomotives in America are fired with a stoker which distributes the crushed coal with steam jets through the boiler backhead. The coal is thus thrown into the firebox through and against the gas stream at the point of its highest velocity. The heaviest coal lumps fall on the grate, but many of the fine coal particles are caught in the high-velocity gas stream and partially burned in suspension while traveling at high speed. During the short time the coal particles pass through the furnace, they must be heated to ignition temperature, the moisture driven off, and the volatile gas distilled and burned before the solid carbon is consumed. It is quite possible that most of the carbon now escaping could be completely burned in the large fireboxes if sufficient oxygen were admitted into the firebox and combustion chamber as secondary air. The beneficial effect of admitting secondary air above the fuel bed has been known for many years and recognized by authorities on combustion as very desirable, yet little has been done.

This subject was investigated by Henry Kreisinger[9] as early as 1917. In these tests it was proved that, with a firing rate up to 185 lb. per sq. ft. of grate and with the thickness of fuel bed varying from 6 to 12 in., all the oxygen in the air which entered through the grate and fuel bed was consumed at the level of approximately 4 in. above the grate.

[9] "Combustion of Coal and Design of Furnaces," by Henry Kreisinger, C. E. Augustine, and F. K. Ovitz, Bulletin No. 135, United States Bureau of Mines, Washington, D. C., 1917.

A sufficient quantity of secondary air admitted above the fuel bed in such a manner as to create a turbulence in the gases would permit of an intimate mixing of the hydrocarbons thrown off by the coal, and provide the necessary oxygen for the complete combustion of volatile gases and carbon. Another very important result from the use of a correct amount of secondary air is that it will help to eliminate smoke which always has been a serious nuisance in locomotive-boiler operation.

Kreisinger states in his report,[9] "the ratio between the weight of air supplied and the weight of fuel gasified remains practically constant at about 7 to 1 so that only about one-half of the 15 pounds of air required to burn the fuel should be supplied through the fuel bed. In order to complete the combustion of all the fuel fed into the furnace, the balance of the air should be admitted above the fuel bed to consume the volatile, as well as fixed carbon present in this zone, or it will escape unburned."

Any scheme to admit secondary air above the fire should be arranged so that the air is controlled in accordance with the demand, in order to keep the excess air at a minimum and not decrease the fuel-burning capacity of the furnace or decrease the over-all boiler efficiency by too much excess air. Several schemes have been prepared to admit secondary air above the fire. The simplest is that of applying air-inlet thimbles in the sides of the firebox and the effectiveness of this should be fully explored. Some studies have been made of the introduction of preheated air by means of blowers. Actual tests have been conducted on one railroad by using blowers without air preheating, but so far no definite advance has been made. It is possible that the cost of such a scheme

Table V—General Dimensions and Boiler Ratios of Eight-Coupled Locomotives

1 Type	4-8-4	4-8-4	4-8-4	4-8-4	6-4-4-6	4-6-2	2-8-2	4-4-2	2-8-2	4-8-4
2 Railroad	Gt. Nor.	Sou. Pac.	A. C. L.	A.T.&S.F.	P. R. R.	P. R. R. K-4-S	P. R. R. L-1-S	P. R. R. E-2-A	Mo. Pac.	U. P.
3 Road class	S-2	G-S-3	R-1	3765	S-1	1737	1752	5266	1699	820-834
4 Date built	1930	1937	1938	1938	1939	1914	1914	1904	1925	1939
5 Boiler pressure, lb. per sq. in.	225	280	275	300	300	205	205	205	200	300
6 Cylinder diameter and stroke, in.	29X29	26X32	27X30	28X32	4-22X26	27X28	27X30	20½X26	2-23X32 1-23X28	25X32
7 Driving wheels, diameter outside tires, in.	80	80	80	80	84	80	62	80	63	80
8 Weight on drivers, lb.	247,300	267,300	263,127	286,890	281,440	202,880	235,800	110,001	244,500	270,000
9 Total weight of engine, lb.	420,900	460,000	460,270	499,600	608,170	309,140	315,600	184,167	340,000	483,000
10 Tractive force, lb.	58,300	62,800	63,900	66,000	76,400	44,460	61,500	23,880	65,700	63,800
11 Boiler diameter, first course, inside, in.	82 11/16	84¼	84½	88¼	91⅛	76⅝	76⅝	65⅝	88	86⅜
12 Boiler diameter, largest, outside, in.	94	96	98¼	102	102	89	89	73	92 11/16	100
13 Length over tube sheets, ft.-in.	22-0	21-6	21-0	21-0	22-0	19-1	19-1	15-1	19-0	19-0
14 Combustion-chamber length, in.	60	80	72	64	113	36	36	....	33	90
15 Grate area, sq. ft.	97.7	90.4	97.8	108	132	69.3	70.0	55.5	66.3	100.2
16 Tube and flue heating surface, sq. ft.*	4,402	4,502	4,181	4,851	5,001	3,729	3,716	2,471	3,437	3,971
17 Firebox heating surface, sq. ft.*	379	385	568	552	660	304	299	157	363	499
18 Total evaporative heating surface, sq. ft.*	4,781	4,887	4,749	5,403	5,661	4,033	4,015	2,628	3,800	4,470
19 Superheater surface, steam side, sq. ft.	2,265	2,086	1,497	2,366	2,085	908	908	....	1,051	1,900
20 Firebox volume, cu. ft.	....	600	613	712	844	380	380	205	390	689
21 Gas area through boiler, sq. ft.	8.94	9.04	9.75	10.30	11.39	9.10	9.10	5.26	8.81	9.90
22 Type of superheater	E	E	A	E	A	A	A	....	A	E
23 Steam area through superheater, sq. in.	69.8	67.1	66.0	78.3	157.1	45.6	45.6	....	51.3	70.4
24 Maximum evaporation, calculated, lb. per hr.	63,640	65,650	74,155	79,675	85,930	52,150	51,750	35,570	52,620	70,380
25 Maximum evaporation, on test, lb. per hr.	....	....	....	....	....	65,400	59,085	30,721	61,680	....
26 Flues, number and diameter, in.	195-3½	198-3½	58-5½	220-3½	69-5½	40-5½	40-5½	....	45-5½	184-3½
27 Tubes, number and diameter, in.	38-2¼	49-2¼	198-2¼	52-2¼	219-2¼	237-2¼	237-2¼	315-2	199-2¼	50-2¼
28 Superheater units, number and diameter, in.	99-1⅜	101-1⅜	58-1½	111-1⅜	138-1½	40-1½	40-1½	....	45-1½	93-1¼
29 Gas area per 1,000 lb. tractive force, sq. ft.	.154	.144	.152	.156	.149	.204	.148	.220	.134	.155
30 Gas area per sq. ft. of grate, sq. ft.	.091	.100	.099	.095	.086	.132	.131	.095	.133	.099
31 Gas area per sq. ft. of tube and flue heating surface, sq. ft.	.00203	.00201	.00233	.00212	.00228	00242	.00246	.00213	.00256	.0025
32 Grate per 1,000 lb. tractive force, sq. ft.	1.68	1.44	1.53	1.64	1.73	1.56	1.14	2.32	1.01	1.57
33 Grate per sq. ft. total evaporative heating surface, sq. ft.	.0205	.0185	.0206	.0199	.0233	.0172	.0175	.0211	.0175	.0224
34 Firebox volume per 1,000 lb. tractive force, cu. ft.	9.90	9.55	9.60	10.80	11.05	8.50	6.18	8.56	5.93	10.80
35 Firebox volume per sq. ft. of gas area, cu. ft.	....	66.4	59.7	69.1	73.0	41.8	41.8	39.0	44.2	69.7
36 Firebox volume per sq. ft. of grate, cu. ft.	....	6.64	5.90	6.60	6.40	5.50	5.44	3.70	5.88	6.89
37 Firebox volume per sq. ft. total evaporative heating surface, cu. ft.	....	123.0	129.0	131.8	149.0	94.4	94.5	78.0	103.0	154.0
38 Firebox heating surface per sq. ft. of grate, sq. ft.	....	4.26	5.82	5.12	5.00	4.39	4.27	2.83	5.47	4.99
39 Firebox heating surface per sq. ft. total evap. heating surface x 100 sq. ft.	7.93	7.87	12.00	10.20	11.67	7.53	7.45	5.97	9.55	11.19
40 Total evap. heating surface per 1,000 lb. tractive force, sq. ft.	82.0	77.9	74.3	81.9	74.0	90.7	67.0	110.0	57.7	70.2
41 Total evap. heating surface per sq. ft. of grate, sq. ft.	49.0	54.1	48.5	50.0	42.9	58.3	58.8	47.4	57.3	44.7
42 Superheat. surface per sq. ft. total evap. heat. surface, sq. ft.	.473	.427	.316	.438	.369	.226	.227	....	.277	.425
43 Gas area through flues, per cent	90.8	88.7	56.5	88.7	57.5	43.5	43.5	....	50.3	89.0
44 Weight on drivers per 1,000 lb. tractive force, lb.	4,240	4,250	4,120	4,350	3,680	4,560	3,830	4,590	3,720	4,230
45 Total weight of engine per 1,000 lb. tractive force, lb.	7,210	7,330	7,200	7,570	7,960	6,950	5,125	7,690	5,170	7,560

*Water side.

may be justified from the standpoint of smoke elimination alone.

Because of the very high draft required in a locomotive boiler, the proportions of the draft-making equipment in the smokebox have received much attention in recent years and a great many tests have been conducted to discover the most efficient front-end design. The best arrangements arrived at differ considerably in design. The important result, however, is that the efficiencies of the draft arrangements have been increased by handling greater quantities of gases with lower back pressure, and that it has been possible to increase the diameter of the stack to a considerable extent without causing the trailing of smoke, which is undesirable from the standpoint of signal observation.

Curves are given in Fig. 4, which show the equivalent evaporation plotted against back pressure. The curve, test *ZM*, shows the improvements gained by the use of an improved front end developed for the New York Central class J1B locomotives as compared with the standard front end.

Superheater

Of all the improvements made on the locomotive, since George Stephenson invented the first one, the superheater holds the first rank. Its great success has been due to the fact that it attacks the heat cycle at a point where the losses are the greatest, i. e., in the cylinders, by the elimination of cylinder condensation during admission and expansion and re-evaporation at exhaust.

Of the many tests made that have proved the beneficial effects of high superheat, those conducted by the Pennsylvania have been the most complete and conclusive. In his report[10] on the performance of the superheated passenger locomotive E6s, C. D. Young presented a most thorough analysis of the beneficial effects obtained by the use of superheated steam. The following summary is quoted therefrom:

"The application of the superheater to this locomotive increases its economy from a minimum of 23 per cent to a maximum of 46 per cent, the economy increasing with the increased power required of the locomotive.

"It was found that 30 per cent higher capacity was derived from the E6s locomotive when using superheated steam than with the same size and type of locomotive using saturated steam."

This result was obtained with a comparatively low superheat, of 200 to 225 deg. F., as compared with present-day practice. This showed an average increase in economy of 1.15 to 2 per cent for each 10 deg. F. increase in superheat. Experience and tests have shown that this rate of increase in economy holds good up to the limits of present acceptable practice of 350 to 400 deg. F. superheat. That every effort must be made to maintain highest superheat temperature is apparent.

This problem has become more and more difficult as the available heat for superheating has been reduced because of the high heat absorption in the large fireboxes of modern locomotives. To compensate for this, much larger superheaters have been found necessary and the introduction of the type-E superheater was a natural development. This type has been used on most modern locomotives which have been built during the last fifteen years in America.

Because of the great influence that the superheater design has upon the efficiency and capacity of both the cylinders and the boilers, considerably more space could

[10] Test Bulletin, No. 21, Nov. 4, 1912, pp. 82-89, 150-151.

Table VI—General Dimensions and Boiler Ratios of Articulated Locomotives

1 Type	2-6-6-2	2-6-6-4	2-6-6-4	4-6-6-4	4-6-6-4	4-6-6-4	2-8-8-2	2-8-8-2	2-8-8-4	4-8-8-2
2 Railroad	C. & O.	S. A. L.	N. & W.	U. P.	Nor. Pac.	D.&R.G.W.	Gt. Nor.	N. & W.	Nor. Pac.	Sou. Pac.
3 Road class	H4A	R2	A	3900	Z6	L105	R2	Y6	Z5	AC7
4 Date built	1927	1937	1937	1936	1936	1938	1929	1936	1930	1937
5 Boiler pressure, lb. per sq. in.	210	230	275	255	250	255	240	300	250	250
6 Cylinder diameter and stroke, in.	20X32	22X30	24X30	22X32	23X32	23X32	28X32	25X32 39X32	26X32	24X32
7 Driving wheels, diameter outside tires, in.	56¼	69	70	69	69	70	63	57	63	63½
8 Weight on drivers, lb.	379,000	330,000	430,100	386,000	435,000	437,939	544,000	522,850	558,900	514,800
9 Total weight of engine, lb.	450,500	480,000	570,000	566,000	624,500	641,900	630,750	582,900	723,400	639,800
10 Tractive force, lb.	81,240	82,300	104,500	97,400	104,500	105,000	146,000	126,838	140,000	123,400
11 Boiler diameter, first course, inside, in.	87	82⅝	91	96⅝	96⅜	92¾	98	95⅝	103¼	91⅞
12 Boiler diameter, largest, outside, in.	93¾	96	105½	102	102	102	111⅛	104¼	110¼	106⅛
13 Length over tube sheets, ft.-in.	24-0	24-0	24-1	22-0	23-0	22-0	24-0	24-0⅝	22-0	22-0
14 Combustion-chamber length, in.	78	72	115½	86	89	109½	84⅛	36⅝	72½	68
15 Grate area, sq. ft.	72.2	96.3	122.0	108.2	152.3	136.5	126.0	106.2	182.0	139.0
16 Tube and flue heating surface, sq. ft.*	4,807	4,914	6,062	4,756	4,993	5,563	7,395	5,207	6,800	5,990
17 Firebox heating surface, sq. ft.*	368	515	588	625	839	778	481	430	866	478
18 Total evaporative heating surface, sq. ft.*	5,175	5,429	6,650	5,381	5,832	6,341	7,876	5,637	7,666	6,468
19 Superheater surface, steam side, sq. ft.	2,246	2,380	2,703	1,630	2,090	2,628	3,515	1,775	3,224	2,601
20 Firebox volume, cu. ft.	....	532	843	862	1,013	1,060	....	630	1,215	....
21 Gas area through boiler, sq. ft.	9.36	9.13	10.95	10.46	11.05	11.20	12.50	10.72	13.61	11.75
22 Type of superheater	E	E	E	A	A	E	E	A	E	E
23 Steam area through superheater, sq. in.	63.5	68.4	80.3	68.3	83.2	79.7	99.4	68.3	98.7	79.7
24 Maximum evaporation, calculated, lb. per hr.	64-450	74,000	88,610	81,550	95,000	98,180	94,060	71,660	115,070	84,400
25 Maximum evaporation, on test, lb. per hr.	....	....	....	....	....	....	....	....	....	....
26 Flues, number and diameter, in.	180-3½ 15-3½	200-3½	239-3½	60-5½	73-5½	238-3½	281-3½	60-5½	280-3½	240-3½
27 Tubes, number and diameter, in.	38-2¼	38-2¼	57-2¼	222-2¼	192-2¼	61-2¼	88-2¼	223-2¼	92-2¼	91-2¼
28 Superheater units, number and diameter, in.	90-1⅜	103-1⅜	121-1⅜	60-1½	73-1½	120-1⅜	141-1⅜	60-1½	140-1⅜	120-1⅜
29 Gas area per 1,000 lb. tractive force, sq. ft.	.115	.111	.105	.107	.106	.107	.086	.085	.097	.095
30 Gas area per sq. ft. of grate, sq. ft.	.130	.095	.090	.097	.073	.082	.099	.101	.075	.084
31 Gas area per sq. ft. of tube and flue heating surface, sq. ft.	.00195	.00186	.00181	.00220	.00222	.00201	.00169	.00206	.00200	.00196
32 Grate per 1,000 lb. tractive force, sq. ft.	.89	1.17	1.17	1.11	1.46	1.30	.86	.84	1.30	1.12
33 Grate per sq. ft. total evaporative heating surface, sq. ft.	.0140	.0178	.0184	.0201	.0262	.0216	.0160	.0119	.0238	.0215
34 Firebox volume per 1,000 lb. tractive force, cu. ft.	....	6.46	8.06	8.86	9.69	10.10	....	4.97	8.68	....
35 Firebox volume per sq. ft. of gas area, cu. ft.	....	58.3	77.0	82.5	91.6	94.6	....	58.7	89.3	....
36 Firebox volume per sq. ft. of grate, cu. ft.	....	5.53	6.90	7.96	6.64	7.76	....	5.92	6.67	....
37 Firebox volume per sq. ft. total evaporative heating surface, cu. ft.	....	98.0	127.0	161.0	173.5	167.2	....	112.0	158.3	....
38 Firebox heating surface per sq. ft. of grate, sq. ft.	5.10	5.35	4.82	5.77	5.51	5.70	3.82	4.05	4.76	3.44
39 Firebox heating surface per sq. ft. total evap. heating surface x 100 sq. ft.	7.10	9.48	8.84	11.62	14.40	12.30	6.11	7.63	11.30	7.38
40 Total evap. heating surface per 1,000 lb. tractive force, sq. ft.	63.6	66.0	63.6	55.4	55.8	60.3	54.0	44.4	54.8	52.5
41 Total evap. heating surface per sq. ft. of grate sq. ft.	71.6	56.4	54.5	49.7	38.2	46.5	62.5	52.9	42.2	46.6
42 Superheat. surface per sq. ft. total evap. heat. surface, sq. ft.	.435	.438	.407	.303	.359	.415	.446	.413	.420	.402
43 Gas area through flues, per cent	81.7	91.2	88.4	54.5	62.8	88.2	86.0	54.0	85.4	82.8
44 Weight on drivers per 1,000 lb. tractive force, lb.	4,660	4,010	4,125	3,970	4,160	4,170	3,720	4,125	3,985	4,164
45 Total weight of engine per 1,000 lb. tractive force, lb.	5,550	5,835	5,455	5,820	5,975	6,100	4,310	4,600	5,160	5,180

*Water side.

be devoted to the discussion of superheater design than is here available. A great deal of research work and testing have been done with many different types of superheater units to discover the unit which will give the maximum superheat with the lowest possible draft loss and steam pressure drop, which is at the same time practical and keeps weight, first cost, and maintenance at a minimum.

The improved type-E superheater is a very excellent arrangement as it gives a combination of maximum evaporating and superheating surfaces coupled with the greatest possible gas area through the boiler and steam area through the superheater. This assures high sustained superheat at low as well as high rating with minimum draft and pressure loss.

Feedwater Heating

A feature of great value in obtaining sustained capacity of the boiler, which may only be mentioned here, is the beneficial effect of feedwater heating. The increase in economy or power output of a locomotive ranges from 8 to 14 per cent through the recovery of the heat in the exhaust steam that otherwise would be wasted. The feedwater heater is now well recognized as necessary for economical locomotive operation.

Conclusion

In conclusion it may be said that the modern locomotive boiler is a very effective steam generator. Boilers[11] which can produce highly superheated steam at a rate of 1 lb. equivalent evaporation per hr. per 1.3 to 1.4 lb. of total boiler weight, compare very favorably with stationary boilers of about the same capacity which weigh about four times as much, or 6 lb. per lb. of steam produced, not including stack, breeching, brickwork, or draft fans. The weight of the locomotive boiler cited includes the boiler complete, superheater, smokebox, front end, stack, stoker, grate, and water.

While continued efforts must be made further to improve the boiler, clearly, it is the engine which deserves the most attention, as its thermal efficiency is so low that even a slight improvement is important. This may mean less simple mechanical parts than in the present reciprocating engine, but the mechanical-maintenance forces of the American railroads have proved to their great credit that very difficult mechanical problems, such as those connected with the maintenance of Diesel and electric locomotives, can be handled successfully.

This gives hope that apparatus and equipment proposed for the improvement of the steam locomotive will receive favorable consideration in the future, and that the hazards of added complications will not be considered as formidable as they once seemed.

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[11] Class M1A, Pennsylvania; Class J3, New York Central.

Pioneer Zephyr Wreck

Damage to stainless-steel train which collided with a standing steam locomotive at high speed confined largely to first unit — Little damage to the locomotive

On October 2, 1939, there was a head-end collision between a Zephyr type motor passenger train and a locomotive and two freight cars on the Chicago, Burlington & Quincy at Napier, Mo. The report of the Bureau of Safety states that the accident caused the death of two employees and the injury of 25 passengers, five railway mail clerks, one employee off duty, one porter, three dining-car employees, and three train-service employees. It was caused, first, by the opening of a junction switch by a trainman without authority or instructions which resulted in diverting the passenger train, the "Pioneer Zephyr," to an occupied track, and, second, by the failure to control the speed of the passenger train properly when approaching a junction operating against the current of traffic within yard limits.

What Happened

The Pioneer Zephyr, train No. 21, consisted of four articulated streamline units propelled by a 600-hp. Diesel-electric power plant. At Forest City, 5.9 miles south of Napier, this train crossed over to the southward track at 4:20 p. m., 2 min. late, and approached the yard limit board at Napier at a speed of about 75 miles an hour. It entered the open junction switch leading to the Wymore division and, while moving at a speed estimated to have been about 45 or 50 miles an hour, collided with locomotive No. 4973 at 4:25 p. m. at a point 859 ft. beyond the switch. The report states that the locomotive and two cars, standing at the water crane and, according to the evidence, with the brakes applied, were moved back 128 ft. by the impact; the driving wheels were derailed to the west and the rear end of the tender was knocked off center; the front end of the locomotive was considerably damaged. The front truck of the first unit of No. 21 was derailed and stopped crosswise of the track 10 ft. from the pilot of locomotive No. 4973; the front end of the first unit rested on the front end of locomotive No. 4973. The front portion of this unit was demolished a distance of 28 ft.; the power plant and its base support were driven back into the mail compartment. The articulation end castings at the rear end of the first unit and at both ends of the second unit were driven inward 8 to 16 in. and the ends of these two units were bent and damaged.

The employees killed were the engineman of No. 21 and the roadmaster who was in the power compartment. The employees injured were the fireman, the conductor, and the brakeman of No. 21.

The Cause

Among the operating rules applying to the conditions involved in the wreck is Rule 98, a part of which reads: "A train authorized to move against the current of traffic must proceed through yard limits at restricted speed." Timetable instructions provide that "Operators when on duty will handle switches at terminals and for movements as follows: . . . Napier Junction switch and crossover . . ." According to the evidence, the flagman of No. 92, the freight train in the yard at Napier, without authority or knowledge of conditions on the road, assumed that the Zephyr train, No. 21, would arrive at Napier on the northbound track, which would not involve the junction switch, and, contrary to the rules, aligned the switch for the movement of his train to the southbound track a few minutes before the arrival of No. 21, running against the current of traffic on that track.

The evidence is conflicting as to the speed at which the collision occurred. Several of the train-service employees of the two trains estimated the speed to have been about 50 miles an hour. The fireman on the motor train, who jumped shortly after the train passed through the junction switch, estimated the speed at that time to have been 45 miles an hour.

Facts Concerning the Stainless-Steel Train

In summarizing the evidence concerning the character of the equipment of the passenger train, the report continues as follows.

The Pioneer Zephyr consisted of four articulated units designed to operate without being intermingled or associated with other cars. It consisted originally of three units which are now the first, second, and fourth units and which were completed in April, 1934; the unit which is now the third unit was added in 1939. The second unit was originally a passenger baggage car and was converted into a full baggage car. These units are built of stainless steel. This material was cold rolled to a minimum tensile strength of 150,000 lb. per sq. in. The total weight of the train empty is shown as 290,000 lb.

The builder's records indicate that this equipment was built according to the Post Office Department specifications for the construction of mail apartment self-propelled cars and trailer mail apartment cars operated in connection with self-propelled cars. In these specifications, which were approved January 2, 1929, it is stated that where the total weight of an empty train does not exceed 300,000 lb., the static end load is to be assumed as 100,000 lb. According to the builder, at the time these cars were built the Association of American Railroads had no specifications which were applicable; however, the specifications issued by the A. A. R. on March 24, 1939, for the construction of new passenger equipment provide for cars which may be used in trains of over 600,000 lb. lightweight, in which specifications it is stated that the Railway Mail Service specifications as revised July 20, 1938, were used as a basis. These specifications state that for a train weighing empty between the limits of 125,000 lb. and 300,000 lb. the assumed buffing static load is 100,000 lb.; this is identical to the 1929 specification. As the stress allowance in the new specification conforms substantially to those of the old specification, the cars conform not only to the 1929 specification, but also the more recent requirement.

According to the specifications of the Post Office Department, when the sills and framing members of rolled

steel have a minimum tensile strength of 50,000 lb. per sq. in., the stress shall not exceed 16,000 lb. per sq. in. This may be increased by 20 per cent for combined direct and secondary stresses and where other materials are used the stresses shall bear the same proportion to the ultimate strength of the material used. For stainless steel the maximum allowable stress is:

$$\frac{16{,}000 \times 1.20 \times 150{,}000}{50{,}000} = 57{,}600 \text{ lb. per sq. in.}$$

The records of the builder show that all stresses are well below this figure.

According to the builder, fabrication was by the Shotweld process, which is made in such a short time as not to affect the stainless properties of the steel and to eliminate appreciable annealing of the cold rolled metal. These units were designed to provide a factor of safety of five above the normal operating loads, as set up by the Railway Mail Service. In the Pioneer Zephyr the strength requirements were met without the use of the conventional center sill, using in lieu of this a floor system including the side sills. The floor system may be considered the center-sill construction of the later specification. The articulation castings were attached to two short sills extending approximately 10 ft. from each end and tied into the floor system. These sills were so attached to the floor system and other reinforcements that the required buffing load was transmitted to all the longitudinal strength members of the floor system. The coach-dinette, the third unit in the train, which was built at a later date, was equipped with a light center sill in addition to the normal longitudinal members, as this had become a standardized design.

Using the required 100,000 lb. buffing load, the builder's records show a maximum calculated stress of 37,530 lb. per sq. in.; as the maximum allowable stress under the 1929 specifications of the Railway Mail Service was 57,600 lb. per sq. in., the structure was so designed and built that it could have carried 50 per cent greater load without exceeding the allowable stresses.

The underframe and engine support of the power car were fabricated of Cromansil steel, arc welded and annealed. The material had a tensile strength of 90,000 lb. per sq. in. and a minimum yield strength of 55,000 lb. per sq. in., with an elongation of 25 per cent in 2 in.

Evaluation of Damage

The statement of the damage to the equipment, furnished by the carrier, showed a total of $54,000 to the first unit, of which $29,000 was to the car body and $25,000 to the power plant; to the second unit, $5,000, and to each of the third and fourth units, $500—a total of $60,000. The damage to the steam locomotive is placed at $400.

Aluminum Alloys Feature Missouri Pacific Trains

(*Continued from page 93*)

tion car. Fluorescent lighting in the dining section of the diner-bar-lounge car requires an additional 630 watts at 110 volts, single-phase a.c. In general, the lighting in these cars gives an intensity of about eight foot-candles at reading level.

A motor-alternator of 1,200-watts capacity, located under the dining car, is used to supply 110-volt current for fluorescent lighting, the radio and the cocktail mixer at the bar. A 300-watt motor-generator on each of the other passenger cars supplies 110-volt current for convenience outlets and the radio.

Safety steam-jet air-conditioning equipment with Vapor controls is applied on each passenger-carrying car, the refrigeration unit being of 7 tons' capacity and mounted under the car. One cooling unit is used per car, except on the diner-bar-lounge car, which has two 3½-ton cooling units, one for the dining section and the other for the bar-lounge section. Tempered air is distributed uniformly throughout the cars by multi-vent aluminum ceiling panels which are hinged for easy cleaning. The total electric load for the air-conditioning pumps, condenser fan and blower motors is about 119 amp, per car on the 32-volt circuit. Electric power requirements for exhaust fans, drinking-water cooler, range oil-burner motor and dish-washer motor reach a maximum of about 35 amps. on the 32-volt circuit in the diner-bar-lounge car.

Vapor heating equipment includes heat-tempering coils in the air-conditioning units and unit fin-type floor heat, all under thermostatic control, steam being supplied from a Vapor-Clarkson steam generator on the Diesel locomotive. Flexible steam conduits, and valves, steam couplers and wash-water heating specialties are also of the Vapor type.

Features of the Truck Design

Four-wheel trucks are used on all cars, with 6-in. by 11-in. journals on the mail-storage car, at the baggage end of mail-baggage car, and at the kitchen end of the diner-bar-lounge car. Other trucks have 5½-in. by 10-in. journals. The 36-in. rolled-steel wheels are carefully balanced before mounting on the A. S. F. roller-bearing unit housings which are equipped on these cars with SKF roller bearings. The wheel treads are ground after mounting, thus producing the good riding qualities resulting from concentric wheel treads and balanced rotating parts. National journal bearings installed in standard A. A. R. waste-packed jornal boxes serve as an added precaution against any car delay due to bearing failure.

The trucks are the single drop-equalizer, swing-motion type, with Commonwealth alloy-cast-steel frames having pedestals cast integral. Both equalizer and bolster springs are helical coil design of alloy steel. Vertical motion is controlled by Munroe shock absorbers and truck bolsters are restrained longitudinally of the car by the rubber-cushioned bolster anchor rods. Lateral sway is controlled on the diners and parlor-observation cars by a stabilizer arrangement, which replaces the conventional spring plank.

Sound-deadening materials, made largely of composition rubber, are used at bolster springs, truck center plates and body side bearings to isolate truck noises completely from the car body. Sound-deadening materials are also used at moving parts of the coupler and face-plate mechanism.

Westinghouse Schedule H.S.C. electro-pneumatic brake equipment with D-22-B control valves are applied on all cars. Speed-governor valves are applied on the baggage-mail cars and on the parlor-observation cars. Automatic emergency track sanding is provided at the inside pair of wheels on the rear truck of the first coach. There are two brake cylinders on each truck centrally located on each side, with Simplex clasp brake equipment having two standard brake shoes per wheel.

There is one Miner hand brake on each car, the vertical hand-wheel type being used at stub ends and the staff type of vestibule ends.

National tight-lock couplers are installed and draft gears are of the Waugh rubber type.

EDITORIALS

Give the Foreman A Chance

The foreman, whether on a railroad or in industry, holds a key position, but unfortunately, while the truth of this is recognized more or less generally, practice in many places does not indicate that it has got very far beyond the theoretical stage. The foreman makes the direct contact with the men in the ranks and to them he is the representative of management. A poor foreman can be a continual friction point as he deals carelessly and unintelligently with the men under his direction. On the other hand, he can be a tower of strength and influence if he deals with them wisely and tactfully.

Generally speaking, he has not had much special training or coaching in the art of dealing with men. This is the responsibility and fault of his superiors. In many instances, however, the foreman has taken the initiative and has given much time and expense to improving his knowledge of the principles of successful supervision. That more of them have not done this is probably due to the lack of understanding of their possibilities, or of how to get the right sort of knowledge and training.

It is a real inspiration to see what many of the local foremen's organizations have done, and the National Association of Foremen's Clubs has made a record of real accomplishment in stimulating its members throughout the nation to a larger appreciation of their responsibilities and the best ways to discharge them.

How are the foremen treated on the railways? In some instances with consideration and appreciation and real assistance in securing a knowledge of how to perform their duties. In other instances, however, the foreman is largely neglected and is regarded more or less as a cog in the wheel. A little round-up of several promising young men who entered the mechanical department in recent years has developed a very disturbing and pertinent fact. After critically studying the situation they have left the shop, in spite of the fact that they liked shop work, because of what they considered the unfair conditions under which a shop supervisor must work, i. e., imminent lay-off.

A railroad officer certainly dislikes, as well as any other man, the necessity of slashing forces when business slows up. In the long run, such a course is wasteful and inefficient. One railroad president has recently gone on record as to his determination to stabilize shop employment, in the knowledge that by so doing it will not only prove a paying proposition, but will be justified on a humanitarian basis. If it is important that this be done all the way down the line, certainly it is of prime importance when it comes to the foremen.

This, however, is not enough. The foremen should be given that attention and appreciation which will qualify them to act intelligently and enthusiastically for the management, and as sympathetic interpreters of the men and management to each other. Friction means waste and costs money. It can be reduced to a minimum by a recognition of the importance and value of the foreman in the organization and by giving him a reasonable amount of attention. It pays to keep cutting tools sharp and in good order. It is just as important to see that the foreman is constantly on the alert and is enthusiastic about his job.

Why Perpetuate Sloping Grates?

One of the details of design that has apparently outlived the conditions which justified its existence is the sloping of grates in the locomotive firebox. Several reasons have been cited as justification for the sloping of the grates downward from the back to the front of the firebox, among which are the necessity of elevating the rear end of the mud ring to allow sufficient clearance for the spring rigging when inside-journal trailer trucks were first introduced and as an aid to the fireman in stoking the front end of the firebox when hand firing was employed. Whatever the reasons are that made it desirable to slope the grates in the past, no satisfactory explanation has been given for the continuance of this design in new motive power.

In his paper before the Railway Fuel and Traveling Engineers' Association at the 1938 convention, F. P. Roesch, vice president of the Standard Stoker Company, called attention to the detrimental effect that the sloping of grates has on the fire bed, particularly in locomotives in high-speed service. The vibrations in these locomotives results in the fire bed creeping forward and building up a heavy fire at the forward end of the firebox and a thin fire at the rear. This condition prevents the admission of sufficient air in the front to support combustion and admits too much at the rear, thereby reducing the effective grate area by the amount covered by the heavy fire.

The beneficial effect that a larger furnace volume has in promoting complete combustion is discussed by C. A. Brandt in his paper on the locomotive boiler which he presented at the last annual meeting of the American Society of Mechanical Engineers. He pointed out that there is a loss of 18 in. in the depth of the firebox at the rear on many locomotives with

sloping grates, a condition that appreciably affects the furnace volume.

It has been proved that the seemingly unimportant details of design have a marked influence on locomotive efficiency. There seems to be no economic justification for the retention of sloping grates while there are very definite advantages to be had by the use of horizontal grates. There should be no hesitancy about discarding any feature of construction that adversely affects locomotive performance.

Fortunate Aspects Of the Zephyr Accident

On October 2, 1939, the first of the light-weight stainless-steel trains built for the Chicago, Burlington & Quincy by the Edward G. Budd Manufacturing Company collided head-on with a steam locomotive and two cars standing with brakes applied. An abstract of the report by the Bureau of Safety of its investigation of the accident appears on another page of this issue. As established by the Bureau's investigation, the accident occurred at a speed estimated variously from something less than 45 m.p.h. to 50 m.p.h. A remarkable feature of the wreck is the relatively small amount of damage done to the body units back of the leading unit which housed the power plant.

Two aspects of the performance of the equipment are of particular interest. One is the completeness of the destruction of approximately half of the first unit with relatively local damage to the rear end of that unit and the ends of the second and third units in the four-unit articulated train. The other is the fact that, with the exception of the front truck, the train stayed in line on the rails.

While the front end of the leading vehicle, in which was housed the Diesel-electric power plant, was badly crushed, the most complete damage occurred back of the power plant where the structure of the car was completely broken in two and separated. Back of this completely destroyed portion, however, the frame of the car was in sufficiently good condition so that it was restored to service by joining to it a newly constructed front section.

The character of the damage suggests that the Cromansil engine bed formed a structure so stiff that where it joined the more flexible stainless-steel floor structure of the car a stress concentration point developed, with complete crushing and destruction of all the longitudinal members of the car body, including sides and roof as well as floor structure. This destruction, localized at the middle and toward the front end of the leading unit, apparently absorbed a sufficient amount of the potential energy in the train so that, with the assistance of that imparted to the locomotive and cars which were moved down the track with the brakes set a distance reported to have been 128 ft., the remaining structures of the train were not subjected to completely destructive forces. There was sufficient local distortion at the rear end of the front unit, at both ends of the second unit, and at the front end of the third unit, however, to dissipate considerable additional energy and none of the passengers who were riding in the third and fourth units was seriously injured.

The fact that the articulation connections between the car bodies kept the train intact as a unit may have had much to do with the protection of the structures of the last three body units. Once the cars in a train separate under collision shocks, all control of the point at which, and direction from which, forces will be applied to the structures is lost, and the full resistance of the strongest part of the structure—that is, the underframe—is not brought into effective use.

It should be pointed out, however, that had there been no cushioning of the shock through the complete destruction of a part of the leading car and had the following cars been sufficiently strong to have remained intact, the probable effect on the passengers might very well have been disastrous. So far as they are concerned, it matters little whether they lose their lives by being thrown about violently within an undamaged car structure or by being crushed in a falling car structure.

In accidents of this kind the protection of the passengers would seem to depend as much on the cushioning effect of the destruction of some parts of the train as upon the resistance to destruction of other parts. The difficulty is to insure the probability that destruction will occur where the passengers are not involved, just as the failure of the front body unit protected the passengers in the accident to the Pioneer Zephyr.

Car Foremen Know Freight Car Details

In far too many instances, individual railroads issue specifications for new freight cars of various types without developing and utilizing as fully as might be desirable the suggestions of repair-track foremen, gang leaders and car supervisors in the lower ranks who know from direct personal contact how the detail parts of present equipment are functioning and which ones need to be improved in new designs. In other words, the chief officer of the car department and the mechanical engineer look at freight-car design from a more or less technical point of view to make sure that any new equipment which is ordered is designed to meet shipper requirements and have adequate strength to carry capacity loads safely. The car-department head also is responsible for the maintenance of this equipment and hence has a definite incentive to include such features of design and specialties as will assure reliable performance and minimum maintenance expense. "Two heads are better than one," however, and 50 heads are better still, so why not make an organized effort to

solicit the ideas of car supervisors all the way down the line when a new design of car is contemplated, for these are the men who really know both service and maintenance requirements to the last detail.

Consider, for example, the following suggestions regarding stock cars, presented by a car-department gang foreman at the February meeting of the Car Department Association of St. Louis. This man, who is intimately acquainted with stock cars from daily observation, says: "Stock-car side slats should be at least 1⅛ in. thick and spaced not over 3 in. apart. Side slats should always be bolted, and edge-grain lumber of a good grade, only, should be used in the space from one foot to seven feet above the floor. Stock-car interiors should be free from any projections, stock bars being located between the door posts. Side-door hasps should be of a collapsible type and side doors constructed so they will swing out at the bottom. Cars with metal roofs should be insulated. Pay more attention to keeping the roofs water-tight. Provide more cars adaptable for both single- and double-deck loading."

The reasons behind these suggestions are thoroughly understood by all well-informed car men. Most of the ideas are absolutely sound and are more or less standard practice on some roads. Probably the question of insulating metal roofs will require additional study, as stock-car sides offer little obstruction to the passage of hot summer air into the car interior, regardless of the type of roof installed. At the same time a load of hogs on the upper deck of a stock car having a metal roof unquestionably suffer severely from the heat when direct rays of the sun beat upon the roof. Presumably, tests should be made, if they never have been, to determine how much the temperature inside the car can be reduced by applying roof insulation.

Similarly, there may be some question about injury to stock from leaky roofs, considering that plenty of rain ordinarily comes in through the car side slats and, in hot weather, stock is frequently wet down with a hose to relieve over-heating. It is true that water leaking on stock in freezing weather would produce undesirable results, but in freezing weather, there would be no water to leak, so the force of this argument is somewhat dissipated. It may be stated as a reasonable conclusion, however, that the roofs of stock cars, as well as other freight cars, should be designed and maintained leakproof at all times.

The ideas quoted above are cited simply to show what one car foreman thinks about one particular type of freight car. Is it not possible that the composite views of a large number of car-department supervisors, from the highest to the lowest rank, covering all types of freight equipment, would be of inestimable value to the railroads, individually and as a whole? As far as joint action is concerned, it would apparently be well for local car foremen's associations to undertake a definite program of developing and co-ordinating the ideas of their individual members, and making this information generally available through their published proceedings. Ideas of general interest bearing on design could then be cleared through the national group of car supervisors, known as the Car Department Officers' Association and submitted for consideration by the Association of American Railroads, Mechanical Division.

New Books

ANNUAL PROCEEDINGS OF THE RAILWAY FUEL AND TRAVELING ENGINEERS' ASSOCIATION. *Published by the association—T. Duff Smith, secretary, 1255 Old Colony Building, Chicago. Price, $2.*

In this volume are the proceedings of the third annual meeting of the consolidated International Railway Fuel and Traveling Engineers' Associations. Following the remarks of L. W. Baldwin, president of the Missouri Pacific, who addressed the coordinated meeting of the Railway Fuel and Traveling Engineers' Association, the Car Department Officers' Association, the Locomotive Maintenance Officers' Association, and the Master Boiler Makers' Association, are the reports and addresses pertaining directly to the work of the Railway Fuel and Traveling Engineers' Association. The subjects reported on were: "AB" Brake Maintenance and Handling; Proper Handling of High-Speed Passenger Trains with Graduated Release; New Locomotive Economy Devices; Avoidable Factors in Design Affecting Fuel and Locomotive Performance; Grates and Ashpans; Stationary Boiler Plants; The Turbine and Condensing Locomotive; Utilization of Locomotives; Locomotive Firing Practice, both Coal and Oil; Fuel Losses and Fuel Wastes; Fuel Records and Statistics.

DIESEL ENGINEERING HANDBOOK. *1939-40 de Luxe Edition. Published by Diesel Publications, Inc., 192 Lexington avenue, New York. Leatherette cover. Price, $6.*

This is a practical book addressed to the man who knows little about mathematics. It is couched in language as simple and non-technical as the subject will permit and will interest men having to do with the operation of Diesel engines who want to broaden their understanding of this type of prime mover. It will also be of value to the engineer whose experience has been in other directions. The book was first published three years ago. Since that time many important developments in the design of Diesel engines and their application have occurred, requiring its revision and rewriting. There are over 900 pages of text in thirty chapters. The book is profusely illustrated with photographs, drawings, and graphs. Not only does it deal with the design and operation of Diesel engines themselves, but there is also a chapter on vibration isolation, as well as chapters on the voltage regulation of Diesel-driven electric generators, flexible couplings, and clutches for Diesel drives.

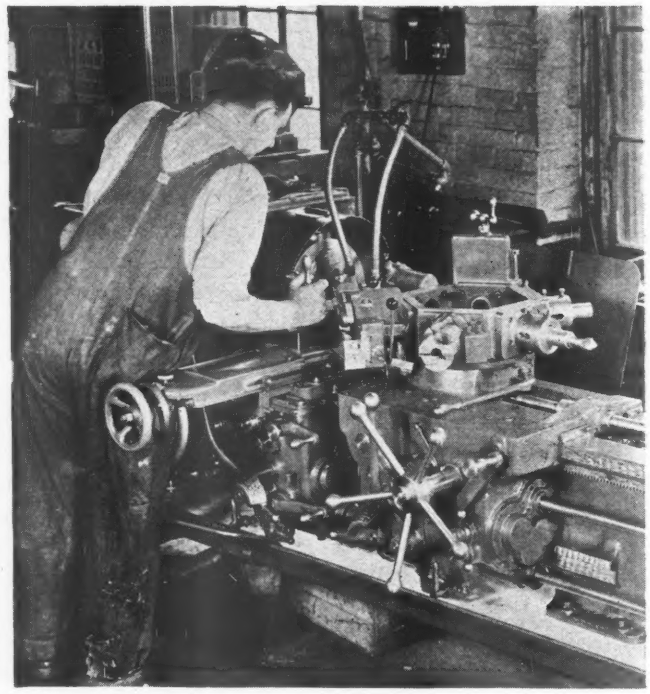
IN THE BACK SHOP AND ENGINEHOUSE

Turret Lathes In Tool Rooms

Precision and small-lot production, required in almost every large railroad tool room, make the job of holding shop operating costs to a minimum a difficult and perplexing problem. One railroad shop management met this problem by installing a modern high-production turret lathe in its tool room where an extensive variety of boilermaker tools and flue cleaners are made. These tools, illustrated in one of the views, include flue expanders, flue setters, rivet-buster pins, rivet snaps and sets, chisel blanks, flue rollers, expander pins and star flue cutters, parts which are made in small lots ranging from one or two per lot up to 12. The only exception is in the star flue cutters which are made in lots up to 1000.

The high-production turret lathe is fast enough to produce more work than two other types of lathes and, in addition, the parts are produced with a better finish and with greater accuracy. Turret lathes have not usually been considered to be tool-room equipment, but there are places such as this one where they can be used to advantage on account of their speed, accuracy and adaptability to the production of small lots.

Standard turret-lathe tools are designed for quick set-up and easy change-over from one job to another which materially reduces the time between jobs. Many of the tools have micrometer adjustment screws and dials which permit them to be quickly set for turning close dimensions. The machine has two single cutter turners which are used for accurately turning bars to correct diameters in the shortest time. The turners are rigidly constructed for taking heavy high-speed cuts and to maintain accurate dimensions. Another tool on this machine is the vertical slide tool used for facing, boring, back facing and recessing. It also has a micrometer adjustment which permits it to be quickly and accurately set for various operations. The quick-indexing square turret tool post holds four different cutting tools such as cut-off tool, right- or left-hand turning tools, chamfering tools, grooving tools, etc. A single to-and-fro movement of the lever unclamps, accurately indexes, and reclamps the square turret. Therefore, any one of these tools is quickly available without loss of time of setting up each individual tool.



Making boiler tools in small lots on a toolroom turret lathe

Boilermaker's tools machined on high-production turret lathe in railroad shop toolroom

Similarly, the hexagon turret holds six different tools any of which may be quickly brought into cutting position by indexing the turret. Many of the same tools are used from one job to the next and may require only resetting or substitution of a different size reamer, drill boring bar, etc., in the standard tool holders.

Modern high-production turret lathes also include many distinct operating features that speed up production and reduce the time required for machine operations. These include such features as power rapid longitudinal traverse to both carriages and also to the in-and-out movement of the cross slide, thus permitting the operator to bring the cutting tools quickly into position with a minimum of effort and loss of time. An automatic spindle brake quickly stops the spindle at the completion of a piece and holds the spindle while rechucking the next piece. Automatic feed stops or trips may be quickly set which facilitates duplicating dimensions when there are several pieces of the same kind to be made. Direct-reading speed and feed plates are provided which tell the operator at a glance the speed and feed he is using. Large micrometer dials, with observation clips are provided on the cross slide and on the cross-feeding hexagon turrets which facilitate quick set-ups or feeding to accurate dimensions. These are only a few of the operating conveniences that make turret lathes fast producers.

Many important features, which make these machines accurate producers throughout a long life, include solid hardened steel ways designed to eliminate practically all wear and preserve the original accuracy of the machine;

a spindle mounted on precision-type taper roller bearings; headstock gears made of high-carbon chrome-molybdenum steel, hardened and having tooth contours ground to give accurate rolling bearing and quiet operation, and an effective automatic built-in lubrication system which assures adequate lubrication to all important bearings and requires only a minimum of the operator's time.

Machine attachments that adapt these machines to practically any set of shop or tool room requirements include bar feeds and collet chucks for bar work, taper attachments for the cross slide or hexagon turret, thread chasing attachments for both the side carriage and hexagon turret carriage, power-operated or hand-operated compound rests for the side carriage, selective gear box and cross-feeding or fixed center hexagon turrets.

Guide Locating Device for Multiple-Bearing Crossheads

As part of a modernization program a southwestern railroad has equipped Mikado type locomotives with multiple-bearing guides and crossheads. In order to secure longer service, close attention is given to the manufacture and erection of the guides and crossheads. Parts are carefully machined to close tolerances, gages being used to check the grooves. Drilling jigs are provided to locate the holes in the guides to insure correct alinement when assembled. After the boring and turning operations, the crosshead is mounted on a special mandrel for machining the plane surfaces, insuring the correct relation of these wearing surfaces to the piston-rod fit.

The construction of multiple-bearing guides and crossheads permits erection as a unit and it has been found practical to locate the guide position accurately by alining the piston-rod fit of the crosshead concentrically with the center line of the cylinder. To facilitate this procedure a locating device, shown in Fig. 4, has been developed.

The guide and crosshead are assembled, placed in position and held by temporary bolts or clamps. The locating device is then placed in the crosshead as shown in Fig. 1. A line through the center of the cylinder and the bore of the device is put up in the usual manner. The crosshead is moved to a central position in the guide and adjusted laterally by testing with a thickness gage. It is locked in this position by the locking screws which are placed in the guide for locking the crosshead in an emergency. The guide is then permanently located by testing for alinement at both ends of the device. By using the centering head and scale as shown in Fig. 2, the entire assembly (crosshead and guide) can be moved until the scale touches the center line. The thickness of the usual center line, if it is of usual thickness, is negligible since the center head may be reversed so that the blade tested against opposite sides of the line, until equal pressure is noted on each side. The blade may then be adjusted in the center head allowing only enough to project so that it just touches the line at one corner of the scale. With the center head so adjusted and by placing it at various positions on the periphery, concentricity may be quickly determined, as shown in Fig. 3.

This device, although designed for use in connection with multiple-bearing guides, may be used to test the alinement of alligator, Laird and other types. Any discrepancy resulting from faulty workmanship, or other causes, is at once apparent.

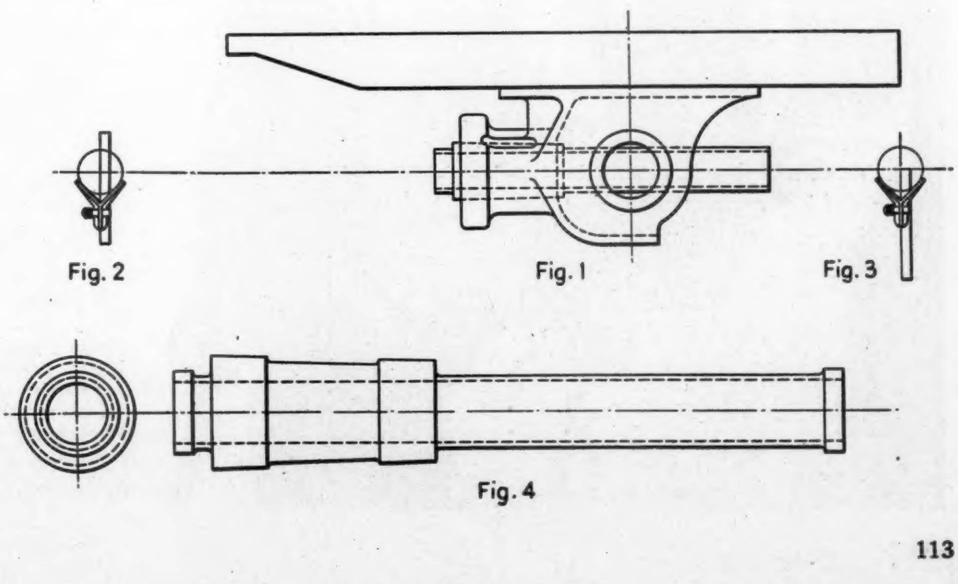
Gas Cutter Has Wide Flexibility

The flexibility of use of the No. 10 Planograph announced by the Air Reduction Sales Company, New York, is demonstrated by its ability to gas-cut straight lines, rectangles, circles, and irregular shapes from ferrous metal of any shape within the present practical limits of the cutting torch. Although a stationary-type machine, the new unit can be readily moved by crane to different localities in the shop.

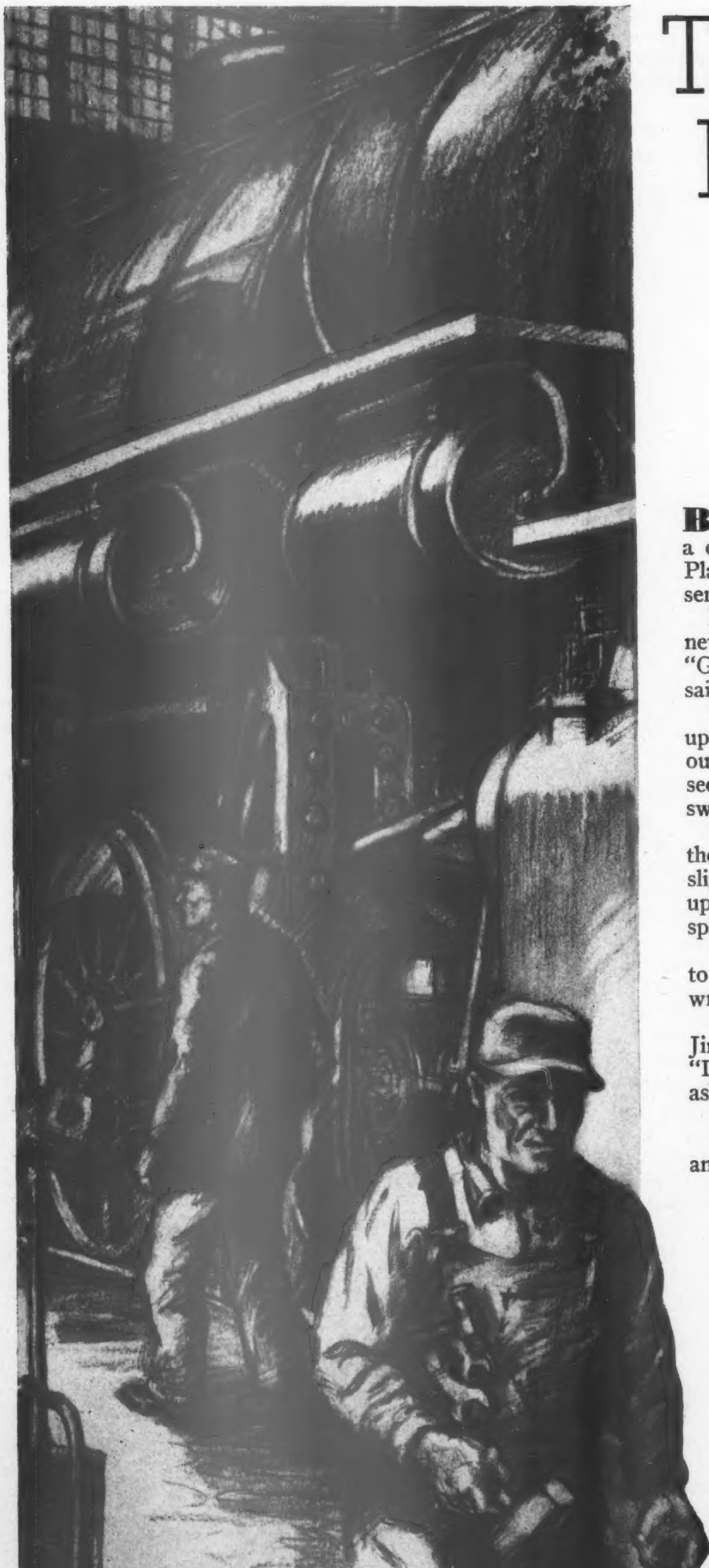
The carriage of the unit travels on a tracing table and supports the torches and the tracing devices. It operates on either 110 or 220 volts, a. c. or d. c. and, including the work table, requires a working area of only 5½ ft. by 10½ ft. The tracing device for manual tracing can be locked so that it will, without manual guiding, travel in a straight line in any desired direction. This time-saving feature is particularly convenient when cutting any irregular shapes which involve straight-line cutting. The devices for magnetic and template tracing can be quickly interchanged in the existing head. The magnetic tracer, connecting directly to an electrical outlet conveniently located near the top of the tracing-device head, requires 110-volt direct current for its operation.

Provision is made at the tracing-device head for connecting a lamp to light the work table. A switch for forward and reverse motion, and the magnet switch are also located at this point. The speed of the motor is

(*Continued on page 117*)



These four figures show the method of using a device for locating guides with multiple-bearing crossheads



THE OTHER FELLOW'S JOB

by Walt Wyre

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BOB Martin is a machinist. He works eight hours a day for the S. P. & W. in the roundhouse at Plainville. Being one of the oldest machinists in seniority, he works seven days a week.

Martin and his helper were just finishing renewing the left main rod bushing on the 5091. "Gosh, I'm glad that job is done," the machinist said. "It was sure one heck of a job!"

"Yeah," the helper agreed as he began to gather up tools. "They're a little mean when the pin is out of round and tapering besides, but I don't see what you're beefing about; I was the one that swung the sledge."

"Well, anyway, it's finished. You gather up the tools and put them in the box. I'm going to slip up in the cab and take a smoke. Come on up when you get the tools put away." The nut-splitter turned and started towards the cab.

"Wish I was a machinist," the helper growled to himself as he started off with an armful of wrenches, sledge, and a heavy buggy bar.

Martin didn't get to take his smoke just then. Jim Evans, the roundhouse foreman, came up. "Did you get through with the 5091?" Evans asked.

"Yeah," Martin replied, "just now finished."

"That's fine," the foreman said. "I've got another job for you. The tire on the right main driver of the 5086 is loose. I want you to reset it."

"O. K.," Martin said with just a trace of resentment. "I'll go tell my helper."

"I've already told him," Evans said.

Setting driver tires is not so bad when the wheels are out from under the engine, but it is something of a job when they are not.

While the helper was getting the tools, Martin went to the cab of the 5086 for a few quick drags on a cigarette.

"Wish I was a machinist," the helper growled to himself as he started off with an armful of wrenches, sledge and a heavy buggy bar

The tire wasn't very loose, but it showed signs that it had been working on the wheel. Both the engineman that came in on the locomotive and the inspector had reported the tire and the foreman had looked at it and decided not to take a chance on running it.

Natural gas used for heating tires in the roundhouse at Plainville has several advantages over kerosene. It is more convenient to handle and does the job in less time.

Evans, short on power as per usual, was anxious to get the 5086 as soon as possible. He paused several times when passing the engine to see how the machinist was coming along with the tire.

They did all right taking the tire off, but ran into a little trouble when they started resetting it. They heated the tire good and hot and it drove off easily. Martin measured the thickness of the shim and found it was $\frac{5}{32}$ in. thick. He told his helper to go to the storeroom and get some $\frac{1}{8}$ in. thick.

"That's going to make it pretty tight, ain't it?" the helper asked when he returned with the $\frac{1}{8}$-in. shim stock.

"Not too tight, maybe," Martin said.

The wheel center was still fairly warm when they started on with the tire. Contact with the tire heated the wheel still more. Martin had a little trouble with the shim and the delay in driving the tire on gave the wheel and tire additional time for the temperatures to equalize.

"It's going pretty slow!" the helper panted as he swung the heavy twelve-pound sledge.

Martin, striking opposite the helper, dropped his sledge to see how the tire was going. If the machinist had not hesitated, the tire might have gone on without sticking, but it is doubtful. It lacked a full $\frac{3}{4}$ in. being up and no amount of pounding would move it any further.

Evans, walking through the roundhouse, came by and stopped to see how they were getting along. He saw at a glance what had happened.

"Better let it cool off and try it again," the foreman said. "While you are waiting for it to cool you might key up the front ends of the main rods. I noticed they were reported." The foreman continued on his way through the roundhouse.

Martin stood watching the foreman walking slowly along. "Yeah, just like that!" The machinist snapped his fingers. "It's easy enough for him to say, but we are the ones that do the work. Wish I was a foreman—they sure have got a snap."

"They have to work twelve hours a day," the helper reminded.

"You mean they are on duty twelve hours a day. I could stand twelve hours doing nothing for the salary they get."

Evans, walking through the house, stopped at the 5077. The engine was overdue at the drop-pit and just begging for classified repairs, yet it was already marked up to run east on another trip. It was that or else. It was up to him to furnish power and the 5077 had to run. Evans shuddered slightly and walked away mentally resolving to tie the 5077 up next time in if it meant tying up the railroad.

Evans left the roundhouse and started to the office. The 5081 was just coming in and the foreman walked over to talk to the engineman. "How did she do?" he asked the hogger.

"She's a wonder!" the engineman replied. "Kept me wondering all the time whether it would fall apart or not."

"You made fairly good time," Evans reminded.

"It'll run," the engineman admitted, "but she sure needs a lot of work. It rides like a Model T on a corduroy road and you'd better do something to that feedwater pump. I could drink water fast as it pumps it into the boiler if I was very thirsty. The boiler needs washing, too," the engineman added as he picked up his tin suitcase and started to the washroom.

"The dispatcher wants to talk to you!" John Harris, the roundhouse clerk, came out of the office and hollered to Evans.

Dispatchers seldom have good news when they call the roundhouse office. They usually want an engine that is not ready or call to report a failure. This time it was a failure. The 5096 had knocked off a main pin while traveling fifty miles an hour. "Tore herself up pretty bad," dispatcher added and hung up.

The accident happened near Sanford and an engine was being sent from there to take the train in, so Evans didn't have that to worry about. The damaged engine would be sent to Plainville next day for repairs.

Evans sat down at his desk and started to look over some mail that had come in. The first thing he picked up was a letter from the master mechanic reminding him in a very emphatic manner that too much overtime was being worked and that it would be a good idea to watch expenses and not run over the allowance as was done the previous month.

"How are we coming on our allowance " Evans asked the clerk.

"Just a minute." The clerk reached in a pigeon hole and pulled out a book. "Not so bad, about three hundred dollars over so far; today is the eighteenth," he added.

"Running nearly twenty dollars a day over," Evans thought aloud. "We've got to do better than that."

"Say, Mr. Evans," Ned Sparks, the electrician came in the office, "the overhead crane in the machine shop is all torn up."

"What happened?"

"Well, you know the 5092 was shoved up with the front end in the machine shop."

"Yes, they are changing the trailer wheels and had to push the engine into the machine shop to get the wheels over the drop-pit. What happened?"

"Somebody run the crane into the front end of the engine."

"How much damage did it do?"

"Haven't examined it yet," Sparks replied, "but it looks pretty bad, the crane, I mean; knocked the headlight off the engine and busted up some of the conduit and wiring."

Evans dropped the letter he was reading and started to the machine shop, the electrician coming with him. Two of the trolley wire supports on the crane bridge were broken off, as was the arm that supported the trolley wheels. One of the trolley wires was burned in half, the two ends dangling on the floor. The platform that carries the controllers was smashed to kindling wood and the light angle iron railing around the platform was bent in a semi-circle around the stack of the locomotive. Altogether it looked like a fair job of tearing things to pieces.

Evans swore, not long or loud, but fervently and with feeling. "How long will it take to get it going?" he asked the electrician.

"Can't say exactly," Sparks replied, "but I'd say at least five or six hours."

"It would happen right when I need the crane to handle a set of drivers that I'm in a hurry to get turned. Well, do the best you can and get it going soon as possible."

"Do you want me to work overtime? It's 3:15 now."

Evans had started to walk away. He stopped and stood a moment thinking of the letter he had just read. "Yes, work until you get it patched up so we can use it first thing in the morning." He started towards the roundhouse again and again the electrician stopped him.

"How about the platform? The carpenter will have to fix that. The hoist controller sets on the platform."

"All right, I'll tell the carpenter." Evans strode from the machine shop, stomping the cement floor at each step.

NEXT morning the 5096 and H. H. Carter, the master mechanic, both reached the roundhouse at about the same time. The official, red-eyed from loss of sleep, had come in on the Limited at 6:15 and didn't appear to be in a very good humor.

Evans was looking at the damaged engine when Carter came up. The dispatcher hadn't exaggerated any when he said it was pretty badly torn up. The main rod was knotted like a pretzel and parts of the valve rigging looked like gigantic corkscrews.

"Standing looking at it is not going to do any good," Carter said. "Why don't you get it in the house and get some men started to work on it?"

"The hostler will put it in the house soon as he gets around with the switch engine that just turned in," Evans said.

"Three failures in less than a week!" Carter continued. "What kind of railroading do you call that?"

"Not so good," Evans admitted.

"I'll say it's not so good. Pretty damned bad if you ask me! If we didn't have the failures I might be able to explain the overtime and running over your allowance, but say!—that pin was over half broke off—been that way no telling how long? Look at that!—where's the inspector?"

"The inspector couldn't have seen that crack with the rods up," Evans pointed out.

"Maybe not, but the rods have surely been off sometime and I'll bet that crack is at least two months old. We can't put up with that kind of railroading."

Evans couldn't think of anything to say that seemed appropriate and remained discreetly silent.

"How's your overtime and allowance coming?" the master mechanic changed the subject abruptly.

"Well, we are having a little overtime and are running some over on the allowance."

"Let's go to the office," Carter said, and started to the roundhouse office.

It's not often that Carter goes on a rampage, but when he does sulphuric acid drips from the corners of his mouth. He started on overtime, got going good on the allowance, worked himself almost into a frenzy about engine failures, and ended up with a vitriolic discourse on slipshod railroading in general as applied to the roundhouse at Plainville in particular.

Several times during the tirade Evans came very near flying off the handle himself, but his better judgment overcame the inclination and he managed to keep still, but at that the foreman didn't like it.

After Carter had left, Evans still stinging under the sharp tongue lashing went from the back room off the office where the monologue was delivered into the main office.

"The master mechanic is kinda on the war path, ain't he?" the clerk said.

"I'll say he is. He went from Genesis to Revelations and everything is wrong. It's easy enough for him to say what should be done, but doing it is something else. If I was a master mechanic and had nothing to do except find fault with foremen, I could find plenty too." Evans, realizing he had said more than he should, left the office.

CARTER, having relieved himself of surplus steam, went to his office feeling a little better but wishing that he had said less. After all Evans was doing as well as could be expected under the circumstances and conditions and a lot better than most foremen would. The allowance was short and no one could run a roundhouse without some overtime. As for engine failures, any man-made machine is bound to fail sometime.

Carter resolved to write a letter asking that the allowance be increased and that two more locomotives be assigned to Plainville—two more *good* locomotives and not ones that had been run on some other part of the railroad until they were ready to fall apart. He would write the letters just as soon as he had finished going through the accumulation of mail on his desk.

The first letter was from the superintendent of motive power and knocked any idea of asking for an increase of the allowance at Plainville. The letter said in no uncertain terms that the mechanical department was expected to stay within the allowance on all divisions, and that master mechanics would be held personally responsible for failure to do so on their respective divisions. The Plains Division was mentioned as one in particular that had in the past been a consistent offender.

Carter scratched his head and reached for another letter. It was from the same official and equally pertinent on the subject of engine failures. The gist of the letter was that unless there were fewer engine failures there would be some changes in master mechanics. In this case the Plains Division wasn't specifically mentioned, but if things kept going as they had been for the past ten days it would be.

Carter continued to read letter after letter until his tired eyes began to feel like his eyeballs had been smeared with grinding compound, the coarse kind.

Well, he would dictate answers to the ones requiring immediate attention, then go home and get a little rest.

Carter managed to keep his eyes open long enough to dictate the letters, but if they had been written exactly as spoken most of them would have read something like this: "To the superintendent of motive power—what did I do with that letter? Here it is—investigation of the failure of engine 5086—doggone I'm sleepy. What did I say, Miss Wilson? Tell them folks in the front office to pipe down; they're talking so loud I can't think. Failure of engine 5080—what was that engine number? —oh, yes, 5086 was caused by—that blamed telephone needs a muffler on it—now where was I——"

Thanks to a competent stenographer, the letters were written so as to make sense. The dictation finished, Carter yawned and relaxed to rest a moment before going home. His heavy eyelids took advantage of the opportunity and dropped over his eyes.

THE master mechanic slept nearly ten minutes. His chief clerk woke him up. "Just got a wire that the 5099 is coming in on the Limited in the morning. The superintendent of motive power wants you to meet it at Middleton and ride it over the division."

Carter woke with a jerk "What's that? Oh, yes, the 5099, it's the one they've rebuilt at the back shop—roller bearings throughout, automatic blowoff, all kind of new dingusses. Call my wife and tell her I won't be home for lunch or dinner either, for that matter. Find out what time 72 is called."

Number 72, a fast freight was called for 11:10. The master mechanic picked up his ever-ready handbag and left the office.

He went to the caboose track intending to put his hand-

bag in the way car, but the switch engine had already taken the caboose to the yard. Carter went to the beanery, lugging the handbag. A piece of pie and a cup of coffee was all he had time to eat. He made the caboose just as the car inspector waved his cap as a signal to the engineer that the train was ready to go as far as he was concerned.

The crew was ready too. A short toot-toot and the train pulled out at 11:14.

Carter looked at his watch and a sleepy smile flickered over his face. He stretched out on one of the long seats on a caboose cushion, one end of which he turned under to form a makeshift pillow. When the rear brakeman closed the main line switch, Carter was sound asleep dreaming of a railroad that ran no night trains, never had engine failures, and the master mechanics had Sundays off.

As long as the train was moving, the master mechanic slept. When it stopped an hour and twenty minutes out of Plainville, he woke up. "Where are we?" he asked the conductor.

"About two miles this side of Norton's Spur," the conductor replied as he opened the caboose door.

"What are we stopped for?"

"Don't know," the conductor answered as he left the caboose and started toward the locomotive.

Carter sat up and rubbed his eyes. He waited about two minutes hoping the engineer would signal the flagman to come in, but he didn't. He put on an overall jumper from the handbag and started to the front of the train.

The right trailer brass was hot, and it *was* hot. The oily waste burst into flames when the box was opened. They cooled the hot journal with water, repacked the box, and were ready to go, but only after losing nearly twenty minutes.

"Think it will run now?" the master mechanic asked.

"Don't know," the conductor replied, "but I doubt it. May have to rebrass it."

Carter sat on the brakeman's seat in the locomotive cab and dozed. The acrid odor of hot oily waste woke him up.

It took forty minutes to cool the journal and put in a new brass, all hands including the master mechanic helping.

Carter rode the locomotive to Sanford, the first division point. While the engine was being serviced, he dropped off at the eating house for a cup of coffee. He rode the caboose from Sanford to Middleton and slept two hours and thirty-six minutes of the two hours and forty minutes it took to make the run.

It still lacked two hours and ten minutes until time for the Limited. While he was waiting, the master mechanic walked over to the roundhouse to see how things were going. They weren't going so good. He found the lead machinist—there is no night foreman at Middleton—and one of the day machinists working on an air pump that had decided to take a pension. The day machinist was on overtime.

"What's the trouble?"

"Don't know," lead machinist replied. "The engineer reported it wasn't working good. We tore into it and can't find anything wrong. Haven't got another engine for the local," the machinist added.

"Shouldn't have any trouble finding what's the matter with it." Carter climbed up the short ladder for a look.

THE headlight of the 5099 was showing in the distance when they got the air pump going. Carter grabbed a piece of waste and rushed to the station wiping his hands as he went. By the time he had gone in the ticket office and out again with his handbag, the Limited was stopping at the station.

Carter intended to look the engine over while it was being worked, then go back to the Pullman and go to bed.

The superintendent of motive power climbed down from the cab of the engine. "Glad to see you," the s. m. p. said. "We've been having hell with that new type injector, and she's not steaming any too good. You ride the engine while I go back and catch a little sleep. Gonna get a bite to eat first."

Carter swore softly to himself, then said out loud: "Dammit, wish I was back helping machinists where I started—nothing to worry about and sleep every night!" He pitched his handbag up to the engine deck and climbed up after it. Five hours to go, nursing a new engine wheeling through the night at seventy miles an hour!

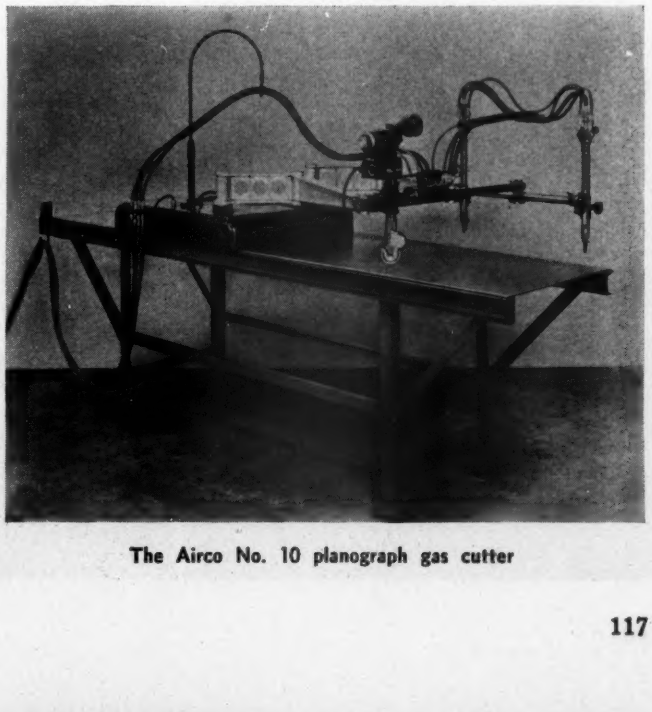
Gas Cutter Has Wide Flexibility

(*Continued from page 113*)

governed by a graduated disc known as the index speed control. One full turn of this disc controls the complete range of the motor speed. The cutting speed in inches per minute is registered on the reversible tachometer.

The gas-control unit on the No. 10 Planograph is centrally located. A knob handle operates cams, progressively arranged, one each for the pilot light, acetylene or other gas fuel, oxygen preheat, and cutting oxygen. One complete cycle lights and cuts off in proper sequence. Handwheels, mounted on either end of this unit, permit the lighting or extinguishing of the torch from either end of the tracing bar.

The cutting range in single-torch operation is 24 in. wide by 72 in. long and the length can be increased in multiples of 72 in. by utilizing additional tracing tables. The maximum diameter of circle cuts is 24 in. When two torches, mounted on the regular operating bar, are employed for simultaneous cutting, the cutting area for each torch is 12 by 72 in. Two circles up to 12 in. in diameter can be cut with the torches mounted in this manner. By using an auxiliary bar, the cutting area of each is 24 by 24 in.



The Airco No. 10 planograph gas cutter

With the Car Foremen and Inspectors

Missouri Pacific Rebuilds Seven Chair Cars

Typical of the passenger car reconstruction programs now being carried out on a number of railroads is the work of the Missouri Pacific in rebuilding seven old-style chair cars at the Sedalia, Mo., shops, as shown in the accompanying illustrations. The original 70-ft. chair cars were of all-steel construction, including the roof, steel and Agasote inside finish and deck, Hale & Kilburn double seats with a capacity for 68, 3-kw. belt-driven electric generators, conventional single-shoe brakes and some of the cars had ice-type air-conditioning equipment applied as early as 1935.

As reconstructed at Sedalia shops, three of these cars were made into deluxe divided coaches and given the new numbers, 6576, to 6578, inclusive. The interiors of these cars were completely redesigned and modernized throughout, two of them being equipped with 7-ton Frigidaire cooling units and one with a 7-ton Safety cooling unit. Double fresh-air intakes were installed in the roof at one end of each car, with an exhaust fan on the far side and the Burgess multi-vent system of air delivery in the main passenger compartments. The divided compartments are 36 ft. and 18½ ft. long and have seating capacities of 40 and 20, respectively, or a total of 60 per car. Modern-equipped men's and women's washrooms are installed at each end of the car. Double reclining back, rotating seats are supplied by the Transportation Seat Company. Continuous basket racks are installed and they support individual reading lights which are controlled from the respective seats. Improved center lights supply the general illumination.

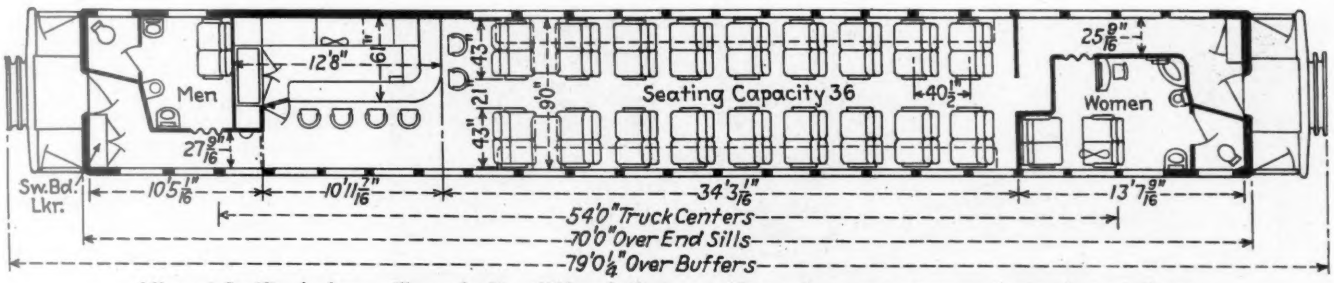
From floor to window sills, the walls of the partitioned cars are finished in British tan at the base and lily-of-the-valley above. Bulkheads and partitions are finished in an artistic blending of these two colors. The ceiling is finished in bone white. The rubber-cushioned seats have walnut mohair upholstery.

Vapor inner-tube floor heat is installed to supplement the overhead heating units, the amount of heating or cooling in the car being under thermostatic control. Electric power for air-conditioning, lighting, operation of the 9-in. railroad-type exhaust fans, etc., is supplied by two 3-kw. generators, with 25-cell A-10-HW batteries. The trucks for these reconditioned cars were transferred from other head-end equipment which had conventional six-wheel trucks with clasp brakes.

Similarly three others of the old chair cars, renumbered 6323 to 6325, incl., were converted into deluxe coaches, each having a single main passenger compartment, 41 ft. 7 in. long, and seating 44. This car has a 15-ft. men's lounge in one end, seating four, and an attractive 13-ft. women's lounge, seating four, in the other end. The total seating capacity of the car is therefore reduced to 52 to make additional lounge and wash room space available.

Air-conditioning and other equipment installed in these cars is the same as in the divided coaches. Double one-part side window are used, with Pantasote curtains, Safety basket racks, Transportation seats and Westinghouse Schedule UC-1812 air brakes. The lighting fixtures were furnished by Safety and the Com-

Attractive modern stainless steel grill and lunch counter in car in one of the deluxe coaches



Missouri Pacific de luxe grill coach, No. 6413, rebuilt to provide maximum passenger comfort and convenience

monwealth cast-steel trucks are equipped with Simplex clasp brakes and 5-in. by 9-in. journals with 36-in. steel wheels. The deck finish is JM Sanacoustic and five plate-glass mirrors are supplied. The ceilings are finished in ivory and side walls with coral stone and rust. The women's lounges are finished in honey yellow and wedgewood blue, while the men's lounges are done in British tan and lily-of-the-valley.

The seventh car, renumbered 6413, is a 70-ft. de-luxe grill coach, equipped with a seven-ton Frigidaire cooling unit and Burgess multi-vent air-distributing system in the ceiling of the car. The car roof is thoroughly insulated and covered with wood and mule-hide canvas, the fresh-air intake being located at one end of the car and an exhaust fan at each end. The main passenger compartment of this car, slightly over 34 ft. long, has a seating capacity for 36; a 10½-ft. men's room seating two is located at one end of the car and a commodious and well-equipped 14-ft. women's room, seating four, in the other end. Between the men's room and the main compartment is an 11-ft. stainless-steel grill and lunch counter, seating six, which brings the total seating capacity in this car to 42, exclusive of the lunch-counter seats.

A feature of the car is the compact, up-to-date kitchen behind the counter, equipped with a sink, coffee urn, griddle, gas burner, steam table, ice-cream container, etc. Additional patrons of the lunch counter are served at removable tables, which are used in conjunction with eight standard chairs, four at a table. This car has the same general type of seats, lights, continuous basket racks and attractive color schemes as are employed in the other deluxe coaches.

Car Yard Walkways

One important feature of car repair yards which may be considered a simple operation but involves considerable expense if figured accurately on an annual basis, is the maintenance of suitable walkways and truck roads alongside the repair tracks and also between the various shop buildings, storehouse, offices, etc. The illustration shows an ingenious method of using the crop ends of carlines, cut at the local mill room and used to form a satisfactory plank floor or walkway between rails. These crop ends are small pieces of 2½-in. oak, 5 in. wide at one end and tapering to nothing at the other end. By nailing two pieces together, with the small end of one against the wide end of another, a plank 2½ in. thick by 5 in. wide by about 40 in. long is formed which can be readily fitted in the desired position between rails and spiked to the track ties. This type of walkway is solid, safe, relatively smooth and durable. When repairs are necessary, it is easy to remove and re-apply small sections at a time. The cost of installation is small, the walkway being made of scrap pieces of lumber which would otherwise have little value.

A solid, safe and durable walkway is made of the crop ends of 2½-in. oak carlines.

Repairing Underframes Of Refrigerator Cars

The steel underframes of refrigerator cars are subject to severe corrosive action and deterioration, especially between the bolsters and the car ends due to the action of brine drippings. One large private car company pays particular attention to making necessary repairs to these underframes, even when the cars are shopped for only medium heavy repairs costing between $400 and $600.

Cars with obviously defective underframes, when received at this shop, are shifted to the repair tracks and old bolts cut loose which secure the car bodies to the underframes. Each car body is jacked up about 10 in., and the underframe pried loose, one end at the time, and allowed to drop back on the truck bolsters, with the car body supported on 8-in. by 8-in. wood timbers resting on suitable horses outside the track. The underframe, resting on its own trucks, is then pulled from underneath the car, as shown in the illustrations, thoroughly inspected to see what repairs will be needed and all new material ordered. Defective parts of the underframe are cut loose, as are also worn parts, consisting primarily of side and end sills, some draft arms, body bolsters, cross-bearers, etc. In general, the rivet heads are melted off

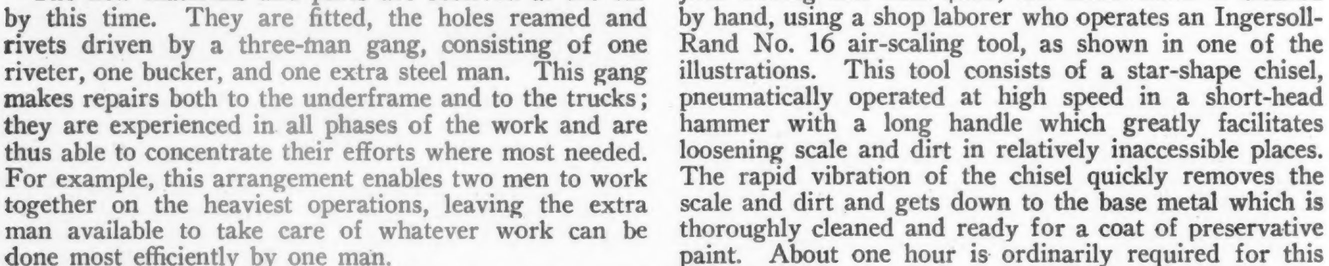
Loosening the scale and dirt from a refrigerator car underframe preparatory to applying a protective coat of car cement

with the gas cutting torch and the rivets backed out, thus permitting the defective parts to be removed.

The new materials and parts are received at the car by this time. They are fitted, the holes reamed and rivets driven by a three-man gang, consisting of one riveter, one bucker, and one extra steel man. This gang makes repairs both to the underframe and to the trucks; they are experienced in all phases of the work and are thus able to concentrate their efforts where most needed. For example, this arrangement enables two men to work together on the heaviest operations, leaving the extra man available to take care of whatever work can be done most efficiently by one man.

As soon as the underframe has been repaired, the next job is to clean it thoroughly of all rust, scale, dirt, etc. In the case of heavy repair cars, the underframe is usually cleaned by sandblasting, but for medium repair jobs costing less than $600, the underframe is cleaned by hand, using a shop laborer who operates an Ingersoll-Rand No. 16 air-scaling tool, as shown in one of the illustrations. This tool consists of a star-shape chisel, pneumatically operated at high speed in a short-head hammer with a long handle which greatly facilitates loosening scale and dirt in relatively inaccessible places. The rapid vibration of the chisel quickly removes the scale and dirt and gets down to the base metal which is thoroughly cleaned and ready for a coat of preservative paint. About one hour is ordinarily required for this operation.

The upper surfaces of the underframe which come in



Refrigerator-car underframe removed from the car body ready for thorough inspection and repair

contact with the car body are then painted and the underframe, supported on its repaired trucks, is pushed back under the car body which has been thoroughly overhauled and repaired in the meantime, defective sills being renewed and other necessary work attended to. The car body is lowered on the underframe in the reverse of the operation previously described and necessary holding bolts and tie rods applied through the side sills, end sills, transoms, draft sills, etc. The car body and underframe are then completely painted and the car is ready for another period of effective service.

Single-Board Refrigerator Car Roof

Water and cinder leakage often give trouble and are the source of damage claims in refrigerator cars, especially those equipped with double-board roofs in which moisture-proof paper is applied between the two layers of tongue-and-groove boards to make them watertight. The fact is that the board surfaces in contact with the paper are ventilated very poorly, if at all, and once they become wet do not thoroughly dry out again. Rotting and roof deterioration accordingly take place and leaks develop in a comparatively short period of time.

The single-board roof design, illustrated in the drawing, is by no means a new development, but competent car maintenance supervisors say that it may be positively relied upon to exclude water and cinders from the car interiors for service periods up to 10 years, providing desirable paint conditions are maintained by shopping the car every three or four years for necessary attention to this important detail. Regardless of the frequency of painting, the double-board roof, on the other hand, is said not to give a satisfactory service life of over four to five years.

The effectiveness of the single-board roof, in excluding water and cinders is due solely to two simple features of construction, namely, (1) the application of 45-lb., three-ply asphalt paper over the old car roofing and new sub-carlines in such a way that there is sufficient slack to prevent any possible tearing of the paper under normal weaving action of the car body; (2) the application of the new single-board outside roof in such a way, as shown in the drawing, that it is fully ventilated and dries out in a short time after being wet.

Referring to the drawing, it will be observed that one course of insulation paper is laid over the old roofing and then the new sub-carlines are applied. A single course of 45-lb., 3-ply asphalt paper is then laid in two strips lengthwise of the car roof, overlapping about 5 in. at the ridge pole, and fitting loosely over the sub-carlines in such a way that there is considerable slack. Experience has shown that if the asphalt paper is fitted accurately to the car roof and laid under the carlines, weaving of the car usually tears the paper and causes leaks, frequently on the first trip. This result is avoided when the asphalt paper is applied as shown in the drawing.

The new sub-purlines and new single-board tongue-and-groove roofing are applied, as indicated, the construction at the car side being such that a 3/8-in. air space is left between the outside fascia and the sub-fascia along the entire length of the car except where the plywood spacing blocks are located. This construction permits any water or cinders which leak through the outside roof to fall on the asphalt paper, work down the incline of the car roof and drop out through the openings at the car sides. By the same token air can pass readily in and out through these openings, thoroughly ventilating and drying the underside of the single-board roof. Freedom from rotting and long roof life, without leakage difficulties are thus assured.

Air Brake Questions and Answers

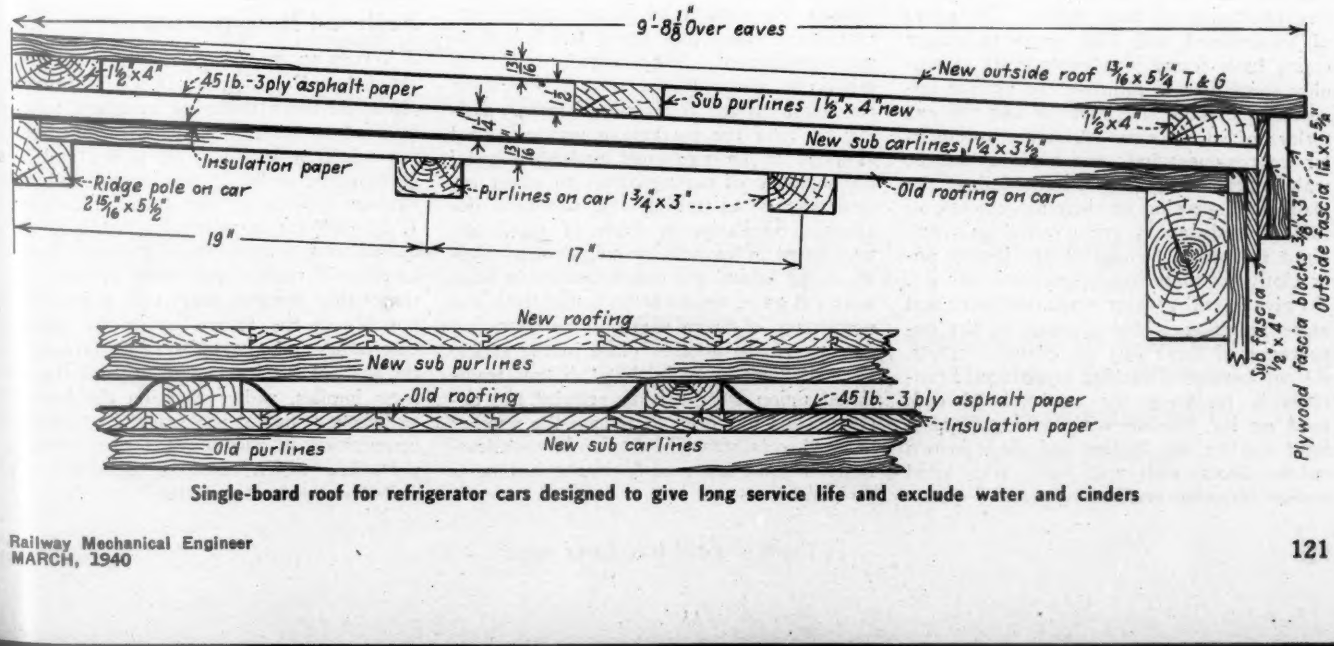
D-22-A Passenger Control Valve (Continued)

551—*Q.—What must be done when applying new shoes?* A.—Turn the ratchet nut to the left, thus moving the cylinder lever toward the brake cylinder until sufficient slack is introduced in the brake rigging.

552—*Q.—What must be done to bring the shoes closer to the wheels?* A.—To bring the shoes closer to the wheels and shorten the piston travel, the ratchet nut should be turned to the right.

553—*Q.—How should the piston travel be adjusted for truck-mounted cylinders?* A.—When the piston travel is less than 4 in. or more than 5 in., the slack adjuster should be adjusted so that the piston travel is 4½ in. with 50 lb. brake cylinder pressure.

554—*Q.—How is the screw adjustment proportioned?* A.—So that the brake shoe is compensated for at the rate of about 1/32 in. for each operation of the adjuster, thereby removing the danger of unduly taking up false travel which would result in the shoes binding on the wheels.



Single-board roof for refrigerator cars designed to give long service life and exclude water and cinders

High Spots in

Railway Affairs . . .

Railroads Foster "Drive-Yourself" Service

It is expected that by May 1, "drive-yourself" automobile service will be made available to railroad passengers in 150 cities in 30 western states, by 11 railroads. An independent organization, The Railway Extension, Inc., Chicago, will own and operate 2,000 automobiles at certain points; it has enlisted the co-operation of "drive-yourself" companies at other points. It will act as the clearing house for automobile reservations, which can be made through railroad ticket agents, such service to be provided at attractive rates.

A Good January

Railway operations for January showed a decided improvement over those for the same month last year; this was also reflected in railway employment. Preliminary reports from 87 Class I railroads, representing 82.6 per cent of the total operating revenues, showed an estimated increase in operating revenues of 12.4 per cent, as compared to January, 1939. Interstate Commerce Commission figures indicate that 988,870 workers were employed in January of this year, or 6.12 per cent more than in January, 1939. While employment in all groups was above that of last year, the greatest increases were an 11.31 per cent rise in maintenance of equipment and stores employees, and a 7.6 per cent increase in the train and engine service group.

Dolling Up Freight Trains

Successful merchandisers have in recent years given much attention to the attractive packaging of their wares. Designers of streamlined and high-speed passenger trains have found it advantageous to employ specialists to improve the artistic appearance of both the interiors and the exteriors of such trains. A rather spectacular improvement has been made in freight train operation, both in scheduling the trains and speeding up their movements, so that long distances are covered in overnight deliveries. Shippers are keenly appreciative of these improvements in service. To give it still greater emphasis, more and more attention is being given to the appearance of these fast merchandise trains. As an example, the St. Louis-San Francisco is replacing the conventional cars used on its Flashes with cars painted a light tan on the bodies and dark brown on the doors, ends and roofs, with vivid orange lettering and markings.

S. 2009 in Conference

It will be recalled that before the adjournment of the last session of Congress, both the House and Senate passed transportation bills which were numbered S. 2009. These differed quite materially in form, as well as in some of the policies. They were referred to conference and it seemed to be understood rather generally that the conferees would get together between sessions of Congress and have something to recommend as soon as the present session of Congress convened. The senators and representatives were busy back home, between sessions of Congress, cultivating their constituents and the conferees only got down to brass tacks in considering S. 2009 last month. Reports are not given out as to the progress which is being made, but enough information has leaked out so that it is pretty well understood that there are marked differences of opinion on some of the more important phases of the proposed legislation. Since the conferees are seasoned legislators, they will undoubtedly find some way of compromising, and there is at least a reasonable possibility of the bill reaching the House and Senate. Just when this may occur, if it does, is hard to predict.

Wage Payments Dependent on Earnings

The Railway Age in an editorial, entitled, "Wages Are Determined by Railroad Earnings, Not By Union Policies," in its issue of February 17, 1940, states that "total wage payments to employees bear, practically speaking, an unwavering percentage relationship to operating revenues." Statistics are presented covering the years 1903 to 1939, inclusive. "In the whole 17-year period," says the Railway Age, "wages never exceeded 50 per cent of operating revenues and never fell below 45 per cent thereof. They actually tended to remain at about 48 per cent of operating revenues, but in the periods of rapidly falling business the percentage was exceeded slightly, to be explained undoubtedly by the inability of managements to effect retrenchments as rapidly as revenues declined. Similarly, in years of rapid improvement in business, re-employment tended to lag behind the improvements in business and gave, temporarily, a slightly lower percentage of wage payments to operating expenses." In another place in the article the statement is made that "all that traditional union wage-raising activity has accomplished has been to reduce the number of employees among whom an independently-determined share of operating income is divided."

New Leader for Railway Labor Executives Assn.

George M. Harrison, young and vigorous railroad labor leader, who has been very much in the forefront during the past six years as chairman of the Railway Labor Executives Association, has resigned because the Brotherhood of Railway and Steamship Clerks, Freight Handlers, Express and Station Employees, of which he is president, "has been experiencing an amazing growth, needed more of his time." He was succeeded by James A. Phillips, a veteran railroad labor leader, president of the Order of Railway Conductors, who has acted as vice-chairman of the Railway Labor Executives Association for a long time.

Eastern Roads Will Go Back to Two-Cent Fare

When it comes to passenger business, the Baltimore & Ohio certainly keeps things stirred up in the eastern territory. It opposed the other eastern railroads in an application for authority to continue the 2½-cent coach rate, which was inaugurated in August, 1938. Because of the World's Fair fares, which were in effect during a great part of last year and which distorted the picture, the railroads contended that more time should be given to experimenting with the 2½-cent fare. In this they were over-ruled by the Interstate Commerce Commission, which in a seven-to-three decision concluded that "The future net revenue results to the eastern railroads will probably be more favorable under a two-cent, than under a 2½-cent basic coach fare." The lower rate will become effective on March 24.

Confidence in Railroad Investments

A forum sponsored by the Savings Bank Journal in Washington, D. C., in January, discussed the attitude of investors toward railroad securities. It lasted for six hours, from 5:00 p. m. to 11:00 p. m., and was participated in by 23 men acquainted with various aspects of the railroad industry. J. E. Oldham, a railroad consultant, suggested that "confidence in railroad investments will return only when investors are reasonably assured that it is going to be possible in the future, as in the past, to determine and maintain rates largely on the basis of service at cost, with all that the term implies, rather than on the basis of expediency made necessary by intensive competition of the newer forms of transportation, which have so generally prevailed since the depression."

(*Turn to next left-hand page*)

Supply the facts which prove that Chilled Wheels cost less. . . . . and the unique exchange plan, whereby a worn-out wheel is worth its weight in new metal, is only the beginning of Chilled Wheel economy. Because Chilled Wheels make possible these **3 additional savings,**

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2. **Longer brake shoe service and**
3. **Lower machine shop costs.**

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Among the Clubs and Associations

MECHANICAL DIVISION, A. A. R.—The Mechanical Division of the Association of American Railroads will meet at the Stevens hotel, Chicago, on June 27 and 28.

NORTHWEST CAR MEN'S ASSOCIATION.—Meeting March 4. Paper: Truck Spring Snubbers. Author: W. S. Spieth, manager, Simplex Snubber Department, American Steel Foundries.

CAR DEPARTMENT ASSOCIATION OF ST. LOUIS.—Meeting March 19, 8 p. m., Hotel DeSoto, St. Louis, Mo. Speaker: C. F. Larson, superintendent of safety, Missouri Pacific. Topic: Safety Movement Evaluated.

SOUTHERN AND SOUTHWESTERN RAILWAY CLUB.—Meeting March 21, 10 a. m., Ansley Hotel Roof Garden, Atlanta, Ga. "Making and Shaping of Steel"—motion picture of Tennessee Coal, Iron & Railroad Company.

CANADIAN RAILWAY CLUB.—Meeting March 11, 8:15 Rose Room, Windsor Hotel, Montreal, Que. Speaker: Lewis C. Ord, general manager, Canadian Associated Aircraft, Ltd. Subject: Development of Air Power and Some of the Resultant Production Problems.

RAILWAY CLUB OF PITTSBURGH.—Meeting February 22. Speaker: O. W. Carrick, assistant vice-president, Electro-Chemical Engineering Corporation. Motion pictures showing behavior of steam and water in a locomotive boiler while in service.

NEW ENGLAND RAILROAD CLUB.—Regular meeting postponed to March 19, 6:30 p. m., Hotel Touraine, Boston, Mass. Reports; election of officers. Address by Dr. Phillip Thomas, research engineer, Westinghouse Electric & Manufacturing Company, with experimental apparatus and gadgets.

DIRECTORY

The following list gives names of secretaries, dates of next regular meetings, and places of meetings of mechanical associations and railroad clubs:

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.—C. E. Davies, 29 West Thirty-ninth street, New York.

RAILROAD DIVISION.—C. L. Combes, Railway Age, 30 Church street, New York City.

MACHINE SHOP PRACTICE DIVISION.—Warner Seely, Warner & Swasey Co., 5701 Carnegie avenue, Cleveland, Ohio.

MATERIALS HANDLING DIVISION.—F. J. Shepard, Jr., Lewis-Shepard Co., Watertown Station, Boston, Mass.

OIL AND GAS POWER DIVISION.—W. J. Hargest, American Machinist, 330 West Forty-second street, New York.

FUELS DIVISION.—A. R. Mumford, Consolidated Edison Co., 4 Irving Place, New York.

ASSOCIATION OF AMERICAN RAILROADS.—Charles H. Buford, vice-president operations and maintenance department, Transportation Building, Washington, D. C.

OPERATING SECTION.—J. C. Caviston, 30 Vesey street, New York.

MECHANICAL DIVISION.—V. R. Hawthorne, 59 East Van Buren street, Chicago. Meeting Stevens Hotel, Chicago, June 27 and 28.

PURCHASES AND STORES DIVISION.—W. J. Farrell, 30 Vesey street, New York.

MOTOR TRANSPORT DIVISION.—George M. Campbell, Transportation Building, Washington, D. C.

CANADIAN RAILWAY CLUB.—C. R. Crook, 4468 Oxford avenue, N. D. G., Montreal, Que. Regular meetings, second Monday of each month, except June, July and August, at Windsor Hotel, Montreal, Que.

CAR DEPARTMENT ASSCCIATION OF ST. LOUIS.—J. J. Sheehan, 1101 Missouri Pacific Bldg., St. Louis, Mo. Regular monthly meetings third Tuesday of each month, except June, July and August, DeSoto Hotel, St. Louis, Mo.

CAR DEPARTMENT OFFICERS' ASSOCIATION.—Frank Kartheiser, chief clerk, Mechanical Dept., C. B. & Q., Chicago. Annual meeting October 21-24, Hotel Sherman, Chicago.

CAR FOREMEN'S ASSOCIATION OF CHICAGO.—G. K. Oliver, 2514 West Fifty-fifth street, Chicago. Regular meetings, second Monday in each month, except June, July and August, La Salle Hotel, Chicago.

CAR FOREMEN'S ASSOCIATION OF OMAHA, COUNCIL BLUFFS AND SOUTH OMAHA INTERCHANGE.—H. E. Moran, Chicago Great Western, Council Bluffs, Ia. Regular meetings, second Thursday of each month.

CENTRAL RAILWAY CLUB OF BUFFALO.—Mrs. M. D. Reed, Room 1817, Hotel Statler, Buffalo, N. Y. Regular meetings, second Thursday of each month, except June, July and August, at Hotel Statler, Buffalo.

EASTERN CAR FOREMEN'S ASSOCIATION.—Roy MacLeod, Room 127, General Office Bldg., N. Y., N. H. & H., New Haven, Conn. Regular meetings, second Friday of January, February, March, April and October at Engineering Societies Bldg., 29 West Thirty-ninth street, New York.

INDIANAPOLIS CAR INSPECTION ASSOCIATION.—R. A. Singleton, 822 Big Four Building, Indianapolis, Ind. Regular meetings, first Monday of each month, except July, August and September, at Hotel Severin, Indianapolis, at 7 p. m.

INTERNATIONAL RAILWAY FUEL ASSOCIATION.—See Railway Fuel and Traveling Engineers' Association.

INTERNATIONAL RAILWAY GENERAL FOREMEN'S ASSOCIATION.—See Locomotive Maintenance Officers' Association.

LOCOMOTIVE MAINTENANCE OFFICERS' ASSOCIATION.—J. E. Goodwin, general foreman, locomotive department Missouri Pacific, North Little Rock, Ark.

MASTER BOILER MAKERS' ASSOCIATION.—A. F. Stiglmeier, secretary, 29 Parkwood street, Albany, N. Y. Annual meeting October 21-24, Hotel Sherman, Chicago.

NEW ENGLAND RAILROAD CLUB.—W. E. Cade, Jr., 683 Atlantic avenue, Boston, Mass. Regular meetings, second Tuesday in each month, except June, July, August and September.

NEW YORK RAILROAD CLUB.—D. W. Pye, Room 527, 30 Church street, New York. Meetings, third Thursday in each month, except June, July, August, September and December at 29 West Thirty-ninth street, New York.

NORTHWEST CAR MEN'S ASSOCIATION.—E. N. Myers, chief interchange inspector, Minnesota Transfer Railway, St. Paul, Minn. Meetings, first Monday each month, except June, July and August, at Midway Club rooms, 1931 University avenue, St. Paul.

PACIFIC RAILWAY CLUB.—William S. Wollner, P. O. Box 3275, San Francisco, Cal. Monthly meetings alternately in northern and southern California.

RAILWAY CLUB OF PITTSBURGH.—J. D. Conway, 1941 Oliver Building, Pittsburgh, Pa. Regular meetings, fourth Thursday in month, except June, July and August, Fort Pitt Hotel, Pittsburgh, Pa.

RAILWAY FUEL AND TRAVELING ENGINEERS' ASSOCIATION.—T. Duff Smith, 1255 Old Colony building, Chicago. Annual meeting, October 21-24, Hotel Sherman, Chicago.

RAILWAY SUPPLY MANUFACTURERS' ASSOCIATION.—J. D. Conway, 1941 Oliver Building, Pittsburgh, Pa.

SOUTHERN AND SOUTHWESTERN RAILWAY CLUB.—A. T. Miller, P. O. Box 1205, Atlanta, Ga. Regular meetings, third Thursday in January, March, May, July and September. Annual meeting, third Thursday in November, Ansley Hotel, Atlanta, Ga.

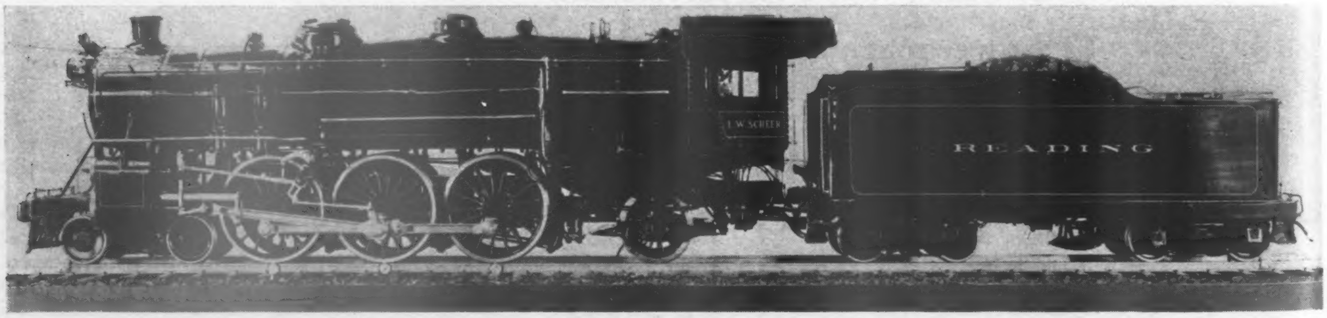
TORONTO RAILWAY CLUB.—D. M. George, Box 8, Terminal A, Toronto, Ont. Meetings, fourth Monday of each month, except June, July and August, at Royal York Hotel, Toronto, Ont.

TRAVELING ENGINEERS' ASSOCIATION.—See Railway Fuel and Traveling Engineers' Association.

VALLEY ANTHRACITE CAR FOREMEN'S ASSOCIATION.—P. P. Kohl, executive secretary, 254 Barney street, Wilkes-Barre, Pa. Regular meetings third Monday of each month.

WESTERN RAILWAY CLUB.—W. L. Fox, executive secretary, Room 822, 310 South Michigan avenue, Chicago. Regular meetings, third Monday in each month, except June, July, August and September.

* * *



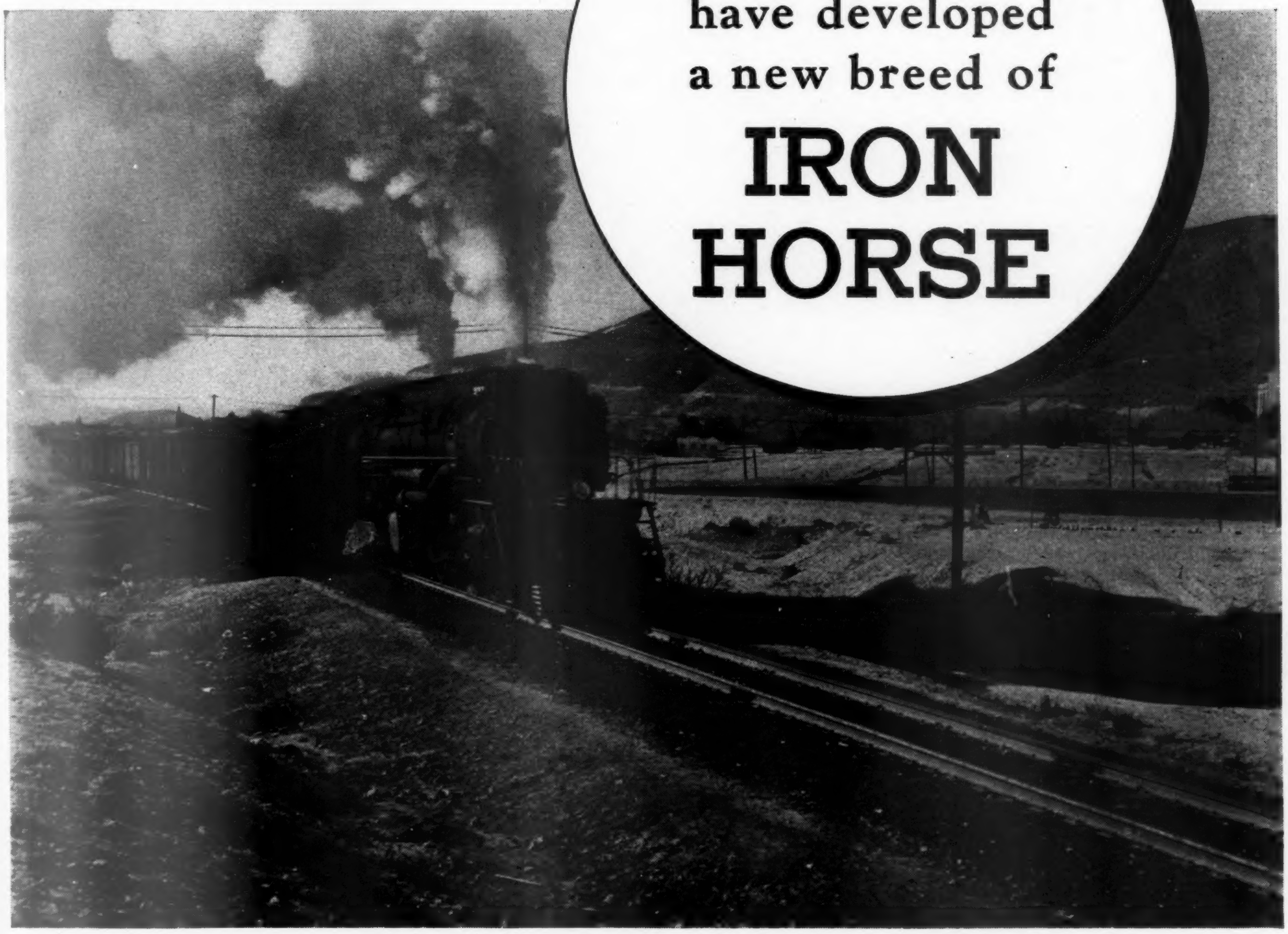
Reading shop apprentices recently completed this one-eight scale working model of a Class G1sa "Pacific" locomotive. The job was done in their spare time

(Turn to next left-hand page)

Changing Conditions

have developed
a new breed of

IRON HORSE



Today's increasing passenger and freight traffic demands have brought about the development of a new type of steam power . . . The Super-Power Steam Locomotive.

Lima has pioneered in locomotives of this type. From the experimental A-1 high-speed freight locomotive of 1925 up to the new improved 2-8-8-4 Mallets, that have recently been delivered by Lima to the Southern Pacific, Lima-built Locomotives have proved the money-making abilities of new, super-power steam locomotives.

LIMA LOCOMOTIVE WORKS — LIMA LOCOMOTIVE WORKS INCORPORATED — INCORPORATED, LIMA, OHIO

NEWS

K. C. S. Buildings Destroyed by Fire

THE general office building, storehouse, freight-car shops, mill room and wheel shop of the Kansas City Southern at Pittsburg, Kan., were completely destroyed by fire on January 18.

Four Hours Added to C. N. R. Shop Work Week

THE Canadian National has announced that its locomotive repair shops will be placed on a 44-hour week, in place of the present 40-hour week, effective immediately. The step has been taken because of a "distinct upturn in business that has taken place and is continuing."

Enlarged Stainless Steel Plant at Massillon, Ohio

ON February 27, the Republic Steel Corporation formally placed in operation improved and greatly expanded stainless steel facilities at Canton and Massillon, Ohio, to meet not only industrial demands, but railway needs for all grades of stainless steel used in car construction. The stainless-steel finishing department at Massillon now occupies all wings of a five-acre building. The plant was previewed on February 27 by a large group of newspaper and trade paper editors, who also inspected a 25-ton electric furnace transferred from Buffalo and a completely new 50-ton unit which was recently added to the company's battery of six electric furnaces at Canton, where the stainless steel is produced.

With the exception of the hot rolling of coils which is done at nearby Warren, Ohio, Republic has now concentrated all its stainless steel operations in the company's plants at Canton and Massillon. The improved and expanded facilities give Republic a stainless capacity in the strip department alone of 1,200 tons per month.

One of 15 polishing machines in the Republic stainless-steel finishing plant at Massillon, Ohio

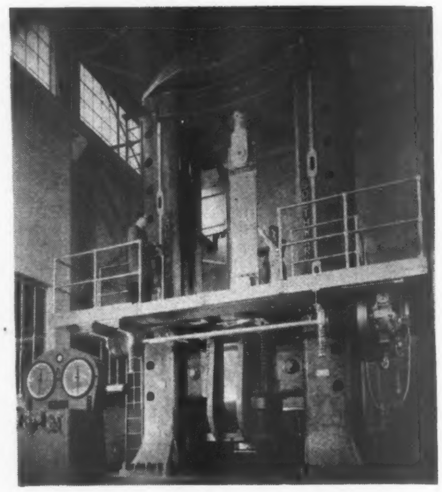
With the new facilities, Republic will be able to produce coils of cold-rolled stainless strip as narrow as ¼ in. and as wide as 23¹⁵⁄₁₆ in. Polishing, which used to be done by the inch, is now done by the foot, the Massillon plant being equipped to polish a sheet 68 in. wide by 24 ft. long.

All Republic's stainless, which is sold under the trade name Enduro, is produced at the east-end plant in Canton. Except for the hot rolling of coils, all the finishing and processing is now done in the Canton and Massillon plants. Unpolished sheets and light plate are finished at Canton and polished sheets and plates and cold rolled strip are finished at Massillon. Part of the 5-acre building at Massillon had to be rebuilt to accommodate new equipment. Included there are three annealing and pickling lines which were moved from Republic's plant at Warren, and three new 4-high reversing mills, the largest a 34-inch unit, and a new 2-high skinpass mill.

A 3,000,000-Lb. Testing Machine Installed in Aluminum Laboratory

A HIGH-capacity, precision-testing and metal-working machine was demonstrated before a group of testing engineers, government officials, railway officers, and industrialists at the Research Laboratories of the Aluminum Company of America, New Kensington, Pa., on March 2. The new machine, called the Templin precision metal-working machine after R. L. Templin, chief engineer of tests, the Aluminum Company of America, was built by the Baldwin-Southwark Corporation and is capable of exerting a force of one million pounds in tension and of three million pounds in compression. While not the largest testing machine in existence, it is the most powerful. In compression, it can exert its full force up to a speed of 36 in. a min., which requires a 300-hp. motor-pumping 270 gallons of oil per min. against a pressure of 1,800 lb. per sq. in. For testing large structural specimens a pump driven by a 20-hp. motor delivers oil against the same maximum pressure at the rate of 18 gallons per minute.

Prior to the installation of the new machine the largest materials testing machine in operation in the company's laboratories was a 300,000-lb. tension and compression machine. A new program of research for the improvement of fabricated products as well as for the development of new ones, requires experimental work using suitable full-size equipment operating under precisely controlled conditions which can be obtained only in the laboratory. The new machine can be operated as an extrusion forging or forming press. Auxiliary equipment permits defining within close limits the relationships existing between the various forces in the plastic flow of aluminum through a wide range of conditions.



The Templin precision metal-working machine—The observers stand on an elevating platform

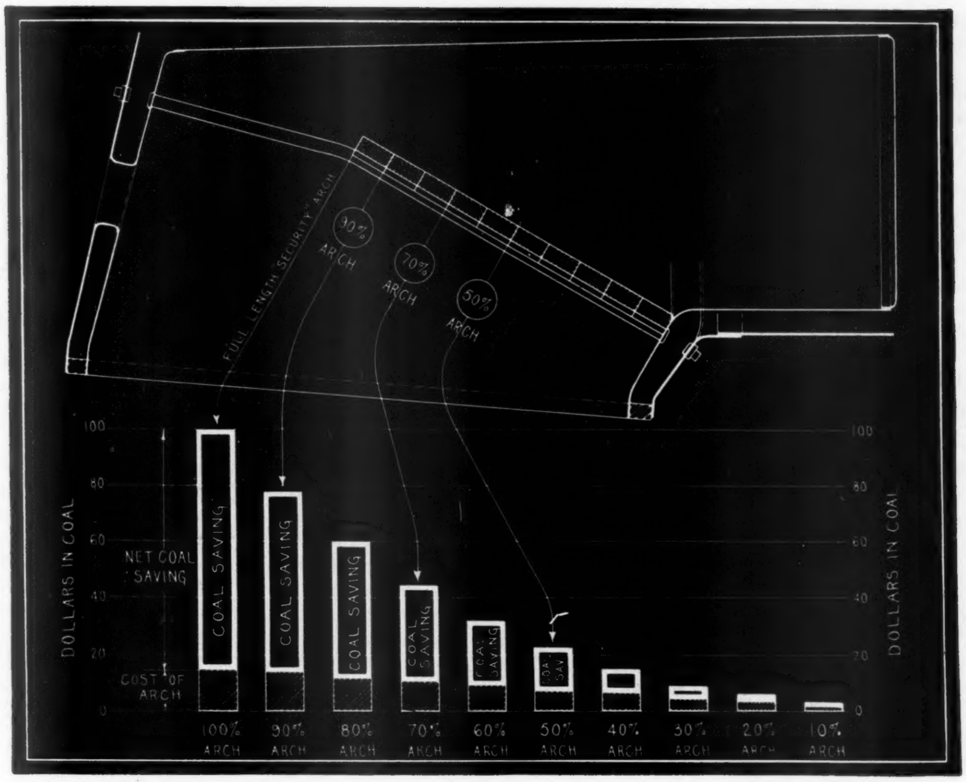
The overall height of the machine is 40 ft. 4 in., of which 25 ft. is above the floor line, the rest below. It is 16 ft. 4 in. wide and 9 ft. front to back. There is ample space available for testing. In compression testing, 90 in. is available from right to left and 108 in. from front to back, with a maximum height of 186 in. In tension testing, a similar space is available from left to right, with a maximum height of 150 in. plus a 36 in. stroke. Dimensions from front to back are not given, because theoretically these dimensions are infinite. The main ram is 46 in. in diameter and has a 36 in. stroke. The pullback rams are 12 in. in diameter. While the hydraulic stroke has a maximum range of 36 in., the heads of the machine can be adjusted over the full height by means of a 50-hp. motor. The motor rotates screws on either side of the machine to effect the desired position of the head.

The Templin machine is capable of weighing a load of three million pounds with an error less than two parts in a thousand and has a sensitivity such that the weight of a man moves the indicator over nearly ¼ in. of arc in the low range.

Pool-Purchase of Covered Hopper Cars Being Investigated

THE Western Association of Railway Executives is investigating the feasibility of a pool-purchase of large quantities of standardized covered hopper cars. The study does not involve the pooling of

(Continued on next left-hand page)



THE EFFECT OF ABBREVIATED ARCHES ON FUEL SAVING

LET THE ARCH HELP YOU SAVE

With the emphasis being placed on saving every railroad dollar, the locomotive Arch becomes increasingly important.

Regardless of the amount of traffic handled, the locomotive Arch saves enough fuel to pay for itself ten times over.

Be sure that every locomotive leaving the roundhouse has its Arch complete with not a single brick nor a single course missing.

In this way, you will get more work for each dollar of fuel expense. Skimping on Arch Brick results in a net loss to the railroad.

THERE'S MORE TO SECURITY ARCHES THAN JUST BRICK

HARBISON-WALKER REFRACTORIES CO.

Refractory Specialists

AMERICAN ARCH CO.
INCORPORATED
60 EAST 42nd STREET, NEW YORK, N. Y.

Locomotive Combustion Specialists

ownership or operation. The purpose of the study is to determine what advantages will result if several railroads purchase the same type of car at the same time. Thus far a committee made up of representatives of several railroads has decided upon a standard design and the association has received bids from the car builders on lots of 500 cars and more. After the bids are analyzed the association will present its findings to member roads for action. At the present time, eight railroads are definitely interested and more are expected to participate if the pool-purchase plan offers substantial inducement.

"Modern Pioneers" in Railroading

"Modern Pioneer" certificates were received by some 500 nominees during February at regional dinners sponsored by the National Association of Manufacturers to commemorate the 150th anniversary of the American patent system. Dinners were held in 14 industrial communities throughout the country, the last dinner being held at New York on February 27 when national awards were also made. An evaluation of the regional awards received by those honored for their contributions in the railroad and railway supply fields follows.

William J. Besler, vice-president and general manager, Besler Systems, Emeryville, Calif., has been a director and active participant in research in high-pressure steam for the past seven years. He has been granted five patents for his work in this connection and has nine other applications pending. He also has eight patents on vacuum power brakes and two pending. The power plant sold by the Besler company to the New York, New Haven & Hartford is now in its fourth year of operation.

Tracy V. Buckwalter, vice-president Timken Roller Bearing Company, was honored, among other things, for his notable research in the application of roller bearings to railroad locomotives and cars. Mr. Buckwalter was granted some 60 patents during his 16 years of service with the Pennsylvania as an employee in the Altoona electric shops (1900-1906) and in charge of automotive engineering, office of general superintendent motive power (1906-1916), and about 100 additional patents during his connection with Timken as chief engineer (1916-1922) and vice-president.

His achievements during direct railroad service centered about the development of electric shop and platform trucks, storage battery locomotives and equipment for rail-highway service.

As a Timken officer, Mr. Buckwalter's activities have been concentrated on the application and manufacture of tapered roller bearings. After successfully adapting such bearings to varied industrial machines and highway vehicles, he joined, in 1929 in designing Timken locomotive No. 1111, which was equipped with roller bearings on all axles and "loaned" to the carriers for demonstration. Mr. Buckwalter was also attracted to the problem of track damage from the unbalanced inertia forces of locomotive reciprocating parts and succeeded in designing die-forged, alloy-steel members for piston, piston-rod and cross-head assembly having about one-half the conventional weight.

Charles A. Campbell, engineer of tests, New York Air Brake Company, who was honored at Rochester, N. Y., is the recipient of a total of 123 patents issued to him solely or jointly and has entered application for 16 additional grants. His most outstanding contribution to railroading may be said to be the development of a graduating type of retardation controller, known commercially as the Declekron, and the electro-pneumatic straight-air controlled brake system with which it functions. This type of braking has made possible the safe operation of high-speed, light-weight trains by improving stopping distance without requiring a higher maximum coefficient of adhesion between wheel and rail. Other of Mr. Campbell's patents have influenced to a marked degree the construction and function of the modern air brake for railroad freight trains. This equipment, known as the AB brake, has been adopted by the railroads for application to all cars in interchange service by 1945. Its adoption followed many years of investigation by the Interstate Commerce Commission and the Association of American Railroads directed toward the discovery and development of a satisfactory brake for long freight trains.

George H. Emerson, chief of motive power and equipment, Baltimore & Ohio, was named a "Modern Pioneer" for his single-drum locomotive water-tube firebox boiler, a description of which appeared in the August, 1931, issue of the *Railway Mechanical Engineer,* page 397. Many other of Mr. Emerson's patents are in use on the B. & O.

Clyde C. Farmer, director of engineering for the Westinghouse Air Brake Company, received a scroll for his invention and development of the "AB" air brake for freight service, for which he has been granted the basic patent covering the principal characteristics and 24 supplementary patents. Mr. Farmer has been granted some 458 patents and was awarded the George R. Henderson Medal by the Franklin Institute in 1938 "for meritorious inventions and discoveries in the field of railway engineering."

Thomas C. McBride and *John F. Grace,* Worthington Pump and Machinery Corporation, Philadelphia, Pa., and Harrison, N. J., respectively, were cited for their various inventions in connection with feedwater heaters and condensers. Mr. McBride was specifically cited for his design of the open-type locomotive feedwater heating system.

George McCormick, general superintendent, and *Frank E. Russell,* mechanical engineer, Southern Pacific, received a joint award for research work done in collaboration. They were cited chiefly for their joint patent for a fusible boiler drop plug, which prevents boiler explosions due to lower water. Mr. McCormick has also received patent grants for a removable driving box; a driving tire retainer; a wheel cooler and several patents for new methods of lubrication. Mr. Russell has received patents for a throttle lever mechanism; a combined body bolster and draw casting and an uncoupling-shaft locking device. Both Mr. McCormick and Mr. Russell have a joint application pending for the improvement of locomotive crank pins and bearings with respect to lubrication.

J. J. Tatum, assistant chief motive power and equipment, Baltimore & Ohio, received his scroll for the use of rubber in passenger-car trucks. His patents cover a wide variety of devices for improving passenger-car design and riding comfort, freight-car trucks, center-sill construction, etc.

W. E. Woodard, vice-president, Lima Locomotive Works, Inc., received his scroll at New York. His most notable contribution to the science of railroading was probably the Lima-built 2-8-2 type locomotive No. 8000 for the Michigan Central described on page 497 of the September, 1922, *Railway Mechanical Engineer.* In this design the fundamental aim was to produce maximum drawbar horsepower for a given driving-axle load, the yardstick for locomotive construction prior to this development having been tractive force. The leveling device for subway cars adopted by the New York subway systems is an invention of Mr. Woodard, as is also the poppet valve gear for use on American railroads described on page 349 of the September 1939, *Railway Mechanical Engineer.* Mr. Woodard has been granted some 80 patents during his career and 11 additional issued jointly to himself and co-inventors. At present he has five patent applications pending in his own name and one in joint application.

Equipment Purchasing and Modernization Programs

Atchison, Topeka & Santa Fe.—The Santa Fe is considering the purchase of Diesel-electric passenger locomotives.

Atlantic Coast Line.—The A. C. L. is rebuilding 1,000 box cars in its shops at Waycross, Ga. These cars were originally built with steel frames and the company is now applying steel sides and U-section truck sides.

Chicago, Milwaukee, St. Paul & Pacific.—The Milwaukee is considering the acquisition of 16 heavy yard and two lightweight branch-line Diesel-electric locomotives.

Colorado & Southern-Ft. Worth & Denver City.—Division 4 of the Interstate Commerce Commission, with Commissioner Porter dissenting, has approved loans of $619,500 to each of these companies by the Reconstruction Finance Corporation. The loans will be used to help finance the purchase of new equipment and will be evidenced by equipment notes bearing interest at the rate of three per cent per year and maturing serially over a period of 10 years in annual installments of approximately equal amounts.

The proceeds will be used for the purchase by each company of a 4,000-hp. Diesel-electric, high-speed locomotive, one diner-lounge car, one mail-baggage car, and one combination baggage-passenger car at a cost of $376,000 for the locomotive and $243,500 for the cars. The two companies will use the new equipment, together with stainless-steel streamline coaches which they now have, to run two streamlined trains in overnight service between Denver, Colo., and Dallas, Texas.

Louisiana & Arkansas.—The Louisiana & Arkansas has asked the Interstate Com-

(*Continued on next left-hand page*)

Flow of Steam to the Cylinders
. . . through the SUPERHEATER

Cross-Sectional Area
of Superheater Unit Tube
1½-in. O.D. Units, #10 B.W.G. Thick

Correct Shape (1)
Full Area—1.14 sq. in.

Flattened ⅛″
Effective Area—1.1163 sq. in., or a 2.1% Reduction

1/16″ Welding
Effective Area—0.9144 sq. in., or a 19.8% Reduction

(1) Steam areas through Elesco Superheater Units, whether new or REmanufactured, are full and unobstructed in their entirety. Have unserviceable superheater units REmanufactured—NOT REPAIRED.

THE SUPERHEATER COMPANY
Representative of AMERICAN THROTTLE COMPANY, INC.
60 East 42nd Street, NEW YORK 122 S. Michigan Ave., CHICAGO
Canada: THE SUPERHEATER COMPANY, LTD., MONTREAL

ELESCO
A-1334

Superheaters « Exhaust Steam Injectors « Feedwater Heaters « American Throttles « Pyrometers « Steam Dryers

merce Commission for authority to assume liability for $1,536,000 of three per cent equipment trust certificates of 1940, maturing in the amount of $52,000 on September 1, 1940, and a like amount on March 1 and September 1 of each year thereafter up to and including March 1, 1943, and $51,000 on September 1, 1943, and a like amount on March 1 and September 1 of each year thereafter up to and including March 1, 1955. The proceeds will be used in part to pay the American Car and Foundry Company for construction and delivery at East St. Louis, Ill., of 300 steel-sheathed 50-ton box cars, costing $834,714, the orders for which were announced in the November, 1939 issue of the *Railway Mechanical Engineer*. Part of the proceeds will also be used to pay for 255 all-steel 70-ton flat cars with bulkheads, built for the transportation of wood pulp, which have already been received from A. C. F. The company also desires to purchase with these funds eight used oil-burning freight locomotives and one used modernized switching locomotive from the Kansas City Southern.

Norfolk & Western.—An improvement program to be carried out by the Norfolk & Western at Lambert Point, Va., includes a new 1,100-car capacity coal classification and storage yard and a new 200-car capacity car repair yard with modern buildings and other facilities. The total cost will be about $500,000. The new classification yard will be on the site of the present car-repair yard and will have 29 additional tracks, a total mileage of about 13 miles with a capacity of from 33 to 47 cars each. The tracks will be built parallel to the present classification yard and will be connected at both ends. The new car-repair yard will have 10 tracks, aggregating about 4½ miles; a new 150-ton track scale and seven modern new buildings, including an oil house, paint house, air-brake house, office and locker room, as well as a storehouse, machine and smith shop, planing mill and lumber shed.

Wabash.—The Wabash has been authorized by the federal district court to spend $746,352, of which $128,555 is for passenger-car improvements.

Western Maryland—The Western Maryland, having certain trucks and other equipment available, placed orders in the latter part of 1939 for sufficient items to complete the assembling of 30 caboose cars in its own shops.

Western Pacific.—The Western Pacific has asked the Federal District Court at San Francisco, Cal., for permission to spend $636,600 as its share of the cost of new lightweight, stainless steel, head-end cars for the Exposition Flyer, operated jointly with the Chicago, Burlington & Quincy and the Denver & Rio Grande Western between Chicago and San Francisco. A similar petition filed by the Rio Grande with the District Court at Denver, Colo., and seeking authority to spend $390,000 was denied on January 13, but the Rio Grande will endeavor to have the decision reversed if permission to participate in the purchase of new cars is granted the Western Pacific. The Burlington's proportion of the cost would be $669,000. The proposed equipment includes baggage, chair and dinette-chair cars.

Three Pendulum Type Cars Being Constructed

CONSTRUCTION of three pendulum type passenger cars, one each for the Atchison, Topeka & Sante Fe, the Great Northern and the Chicago, Burlington & Quincy, has been started by the Pacific Railway Equipment Company. Early development work on this type of equipment was sponsored by C. T. Hill, son of Louis W. Hill, retired chairman of the Great Northern. It culminated about two years ago in an articulated two-car unit, the principal interest in which centers about the suspension system or method of mounting the car on the truck. The design departs completely from standard practice in that the car body is suspended from the truck, floating on soft vertical coil springs in a plane above the center of gravity of the body. The springs permit, through horizontal deflection, all of the necessary truck motion relative to the body, the motion being positioned and controlled by a pair of horizontal links elastically restrained by rubber, acting between the body and the truck frame at a height well above the body center of gravity.

The Atchison, Topeka & Santa Fe cooperated in the early development to the extent of providing motive power and testing facilities. When the new cars are completed later this year they will be operated by the owning roads as a single train in experimental service.

Jurisdictional Disputes To Be Settled by Shop Crafts

PLANS for settling jurisdictional disputes among themselves without interruption of service and without calling upon railway management to intervene were put into effect on February 15 by six of the seven shop-craft unions affiliated with the Railway Employees' Department, American Federation of Labor. The electrical workers did not subscribe to the plan which was announced by B. M. Jewell, president of the Railway Employees' Department, A. F. of L., and hailed in "Labor," organ of the railroad brotherhoods as "an important step toward peaceful adjustment of jurisdictional disputes between shopcraft unions on the railroads."

Mr. Jewell explained that the new machinery is the result of 13 years of effort by the executive council of the department. "Essence of the plan," he said, "is that employers shall not be called upon, nor permitted, nor requested to settle disputes between the unions. Nor shall an employer's work be interfered with because of jurisdictional disputes. It is the right and obligation of the organizations involved to settle such controversies among themselves."

Orders and Inquiries for New Equipment Placed Since the Closing of the February Issue

LOCOMOTIVE ORDERS

Road	No. of Locos.	Type of Loco.	Builder
Northern Pacific	1	660-hp. Diesel-elec.	Baldwin Loco. Wks.
	3	1,000-hp. Diesel-elec.	Electro-Motive Corp.
Oliver Iron Mining Co.	3	Diesel-elec.	Baldwin Loco. Wks.
	7	Diesel-elec.	American Loco. Co.
Wabash	1	660-hp. Diesel-elec.	American Loco. Co.
	1	660-hp. Diesel-elec.	Electro-Motive Corp.

LOCOMOTIVE INQUIRIES

Road	No. of Locos.	Type of Loco.	Builder
New York Central	25	4-8-2	....

FREIGHT-CAR ORDERS

Road	No. of Cars	Type of Car	Builder
Atchison, Topeka & Santa Fe	27	100-ton ore	Pressed Steel Car Co.
General American Trans. Co.	500	Refrigerator	Company shops
New York Central	500	70-ton hopper	Despatch Shops, Inc.
New York, Chicago & St. Louis	50	70-ton hopper	American Car & Foundry Co.
	10	Gondola type container cars	Pullman-Std. Car Mfg. Co.
	110	Steel container	Pullman-Std. Car Mfg. Co.
St. Louis Refrigerator Car Co.	25	Refrigerator	Company shops
U. S. War Dept., Chief of Engineers	24	40-ton box	Greenville Steel Car Co.
	6	40-ton flat	Haffner-Thrall Car Co.

FREIGHT-CAR INQUIRIES

Road	No. of Cars	Type of Car	Builder
Chicago, Burlington & Quincy	50	50-ton box	....
Denver & Rio Grande Western	10	Caboose	....
Gulf, Mobile & Northern	1,000	40-ton box	....
	200	70-ton hopper	....
	250	50-ton hopper	....
National Tube Co.	2	70-ton gondola	....
	6	70-ton hopper	....
New York Central	1,000	Freight	....
Tennessee Copper Co.	8	50-ton air-dump	....

PASSENGER-CAR ORDERS

Road	No. of Cars	Type of Car	Builder
Ft. Worth & Denver City and Colorado Southern		Equipment for 2 trains—See Note [1]	
	1	Diner-lounge	[2] Edward G. Budd Mfg. Co.
	3	Coaches	[2] Edward G. Budd Mfg. Co.
	1	Baggage	[2] Edward G. Budd Mfg. Co.

[1] Equipment for Zephyrs 11 and 12, the Texas Zephyrs, will be placed in service this summer by the F. W. and D. C. and Colo. Sou. (subsidiaries of the C. B. & Q.), between Dallas, Tex., and Ft. Worth and Denver, Colo. The two units comprising each of the 4,000-hp. Diesel-electric locomotive, will be built by the Electro-Motive Corporation. The stainless-steel mail-express car, the baggage-coach, the two de luxe chair, and the dining-lounge cars will be built by the Edward G. Budd Manufacturing Company. The remaining three cars of the 10 units, which will comprise each train, will be standard Pullman sleeping cars.

[2] These five stainless-steel passenger cars will be used on principal trains operating out of Chicago.

(*Turn to next left-hand page*)

This conventional ten car passenger train was used in tests.

7410-MILE ROAD TESTS

scientifically prove value of

WAUGHMAT

TWIN CUSHIONS

Instrument records of exhaustive tests reveal, in indisputable form, the comparative values of Twin Cushions, Friction Draft Gears and other arrangements in eliminating and reducing jerks and jars, horizontal, lateral and vertical shocks, surging, and stresses in the draft gear yoke and coupler shank. Report now ready for personal presentation to technical executives.

WAUGH EQUIPMENT COMPANY

NEW YORK CHICAGO ST. LOUIS

Canadian Waugh Equipment Company, Ltd., Montreal

Engineers' Report on Streamliners

The statistics of 100 "streamline, light-weight, high-speed passenger trains" show without doubt that they are highly popular and proved financial successes, according to an 82-page report prepared by Coverdale & Colpitts, consulting engineers, New York, for the Edward G. Budd Manufacturing Company, Philadelphia, Pa. Covering traffic and earnings statistics of selected trains for the years ended June 30, 1938, and 1939, the report has been made for the purpose of bringing the figures of a basic report dated June, 1938, (reviewed in the December 1938, *Railway Mechanical Engineer*, page 499) down to June 30, 1939. Classification of material and methods of analysis are similar in both reports, and the preparatory discussion of the field of streamliners is repeated exactly in this latest "edition."

For each train touched on, the report gives a short history, details of consist, seating capacity, etc., characteristics of regular routes, speed averages and, where obtainable, revenue and traffic statistics. The latter are lacking for a number of the trains, however, because the railroads do not segregate the applicable figures from total train returns.

Statements of revenues and expenses do not include the items of interest, depreciation, taxes or insurance, since these overhead charges are not directly assignable to train operation. For a similar reason, terminal rentals are also omitted from the calculations.

The report credits the rapid extension and improvement of streamliners to a number of organizations. Pullman-Standard Car Manufacturing Company and the Edward G. Budd Manufacturing Company are cited as leaders in new car construction; the Electro-Motive Corporation for its development of the Diesel two-cycle engine practicable for high-speed locomotives and the Union Pacific, Chicago & North Western, Southern Pacific, Chicago, Burlington & Quincy, Atchison, Topeka & Santa Fe and the Chicago, Rock Island & Pacific for their promotion of modern passenger-train equipment on their respective lines.

The Santa Fe operated the largest fleet of streamliners as of June, 1939, according to the report. Amounting to 15 separate trains, they consisted of a total of 61 cars. The two Daylights of the Southern Pacific operating between Los Angeles, Cal., and San Francisco, earned $5.28 per train-mile during the year ended June 30, 1939, which exceeds the "take" of any other train during the period covered in the report. The Daylights also enjoyed exceptionally high net earnings—$3.85—or 72.9 per cent of gross revenues.

The highest ratio of net revenues to gross of any train in the report is found in the figures for the two Afternoon Hiawathas of the Chicago, Milwaukee, St. Paul & Pacific, which cleared 75.7 per cent of gross for the year ended June 30, 1938, and 75.3 per cent in the following year.

Supply Trade Notes

F. M. Huffman, assistant manager of sales at Baltimore, Md., of the Bethlehem Steel Company, has been appointed assistant general traffic manager, with headquarters at Bethlehem, Pa.

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Frank J. Dolan, assistant secretary and assistant treasurer of The Superheater Company, has in addition to these duties, been appointed assistant to vice-president, sales, with headquarters at New York.

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H. C. Sauer, manager of the Chicago branch of the service-sales division of the Timken Roller Bearing Company, Canton, Ohio, has been transferred to New York to succeed J. W. Berriman, who has been granted a leave of absence. L. J. Halderman, manager of the Kansas City, Mo., branch, has been transferred to Chicago and has been succeeded by F. A. Weisenberger.

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C. H. McGrath, general purchasing agent of The American Brake Shoe & Foundry Co., New York, has been appointed assistant to the president and W. T. Kelly, Jr., assistant to general purchasing agent has been appointed general purchasing agent, reporting directly to the president, succeeding Mr. McGrath.

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Joseph T. Ryerson & Son, Inc., Chicago, has completed a reconstruction and expansion program at its plant in Philadelphia whereby floor space has been increased 250,000 sq. ft. The improvements include a high-bay type mill building 185 ft. by 120 ft. and a finished products building with 20,000 sq. ft. of storage space as well as modern cutting equipment, a new heating plant and office improvements.

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Harold S. Brooks, assistant to vice-president and manager of sales of W. H. Miner, Inc., Chicago, has been appointed sales manager succeeding William E. Robertson, vice-president and manager of sales, who died on January 31. Mr. Brooks was born in Prescott, Ark., on February 10, 1893, and attended Lewis Institute, Chicago. In 1914 he entered the employ of the Van Dorn Coupler Company, Chicago, as private secretary to the

Harold S. Brooks

president, and later worked in the mechanical and sales departments. During the World War he was in the U. S. Navy. In 1919 he returned to the Van Dorn Company as manager of its Chicago sales office, and later was promoted to general manager. In April, 1923, he entered the employ of W. H. Miner, Inc., serving in the testing laboratory and other branches of the mechanical department until 1927 when he entered the sales department of that company, later being made assistant to the vice-president and manager of sales.

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Frank W. Lampton, representative in the southwest of the Hunt-Spiller Manufacturing Corporation, Boston, Mass., has been appointed assistant sales manager, and Kenneth A. Craig, locomotive inspector of the Kansas City Southern, has been appointed representative of Hunt-Spiller in the territory formerly covered by Mr. Lampton. Mr. Lampton served his machinist apprenticeship with the St. Louis-San Francisco, and from 1916 to 1923 as foreman at various places on the system. He was then appointed general foreman at Springfield, Mo., serving until January 1, 1926, when he was appointed representative of the Hunt-Spiller Manufacturing Corporation. Mr. Craig took an engineering course at the Carnegie Institute of Technology, Pittsburgh, Pa. He entered the employ of the Erie in 1918 as machinist apprentice and later served, consecutively, as junior valuation engineer and chief dynamometer and track inspection car operator, having charge of all road tests. In February, 1928, he went to the Kansas City Southern as dynamometer engineer, in charge of road and locomotive tests. He was appointed traveling locomotive inspector in 1937, and during the past year has had charge of operation and maintenance of Diesel-electric locomotives.

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American Locomotive Company.—William C. Dickerman has been elected chairman of the board; Duncan W. Fraser, president, and Robert B. McColl, vice-president, manufacturing of the American Locomotive Company. Mr. Dickerman was formerly president; Mr. Fraser, vice-president, and Mr. McColl, vice-president, Alco Products Division.

William Carter Dickerman, chairman of the board, was born on December 12, 1874, at Bethlehem, Pa. Following his graduation from Lehigh University in 1896 he entered the employ of the Milton Car Works, Milton, Pa., where he served successively in the auditing, purchasing and

engineering departments. In 1899, on formation of the American Car and Foundry Company, of which the Milton Car Works became a part, he was appointed assistant manager of the Milton, Pa., district. Transferred to New York in 1900, he was appointed sales agent, and later general sales agent, in which position he remained until 1905 when he became vice-president. During the war Mr. Dickerman was in charge of the division of the American Car and Foundry Company which executed munition contracts on behalf of the United States and the allied nations. In 1919 he became vice-president in charge of all operations of that company, and in 1929 was elected president of the American Locomotive Company. Mr. Dickerman is a member of the Executive Committee and a director of the following companies: American Car and Foundry Company, American Car and Foundry Export Company, American Car and Foundry Securities Corporation, Carter Carburetor Co., General Steel Castings Corporation, J. G. Brill Company, and Montreal Locomotive Works. He is chairman of the board of directors and chairman of the executive committee of the Transamerican Construction Company; a director of the American Canadian Properties Corporation, the American Car and Foundry Motors Company, the Brill Corporation, First Milton (Pa.) National Bank, the Flannery Bolt Company, the Shippers Car Line Corporation, and Superheater Company, the United Gas Improvement Company; chairman of the board, member of the executive committee and a director of the American Locomotive Company; president and director of the American Locomotive Sales Corporation; president and a member of the executive committee The Guild of Brackett Lecturers (Princeton University); a trustee of Lehigh University where he recently received the honorary degree of Doctor of Engineering; a director of the Southampton (L. I.) Hospital Association; a member of the U. S. Chamber of Commerce; a member of the Chamber of Commerce of the State of New York. His memberships in other organizations include the American Society of Mechanical Engineers, the American Institute of Mining and Metallurgical Engineers, the Newcomen Society, etc.

W. C. Dickerman

Duncan W. Fraser, president of the American Locomotive Company, was born in Pictou County, Nova Scotia. He served his apprenticeship at the Rhode Island Locomotive Works. In 1904, when the American Locomotive Company acquired the Montreal Locomotive Works, Ltd., Mr. Fraser was transferred to the Montreal Works where he served in various capacities, including that of works manager and managing director. In 1920 he became vice-president of the American Locomotive Company, with headquarters at New York. In 1924 he became a director and in 1939 a member of the Executive Committee, and now succeeds Mr. Dickerman as president of the company. Mr. Fraser is vice-president and director of the Montreal Locomotive Works, a member of the Executive Committee and a director of the American Locomotive Company, the General Steel Castings Corporation, and the Canada Iron Foundries, Ltd. He is also a member of the executive committee and a director of the Dominion Steel and Coal Corporation, Ltd., and the Dominion Coal Company, Ltd., and a director of their affiliated companies.

D. W. Fraser

Robert B. McColl, vice-president, manufacturing, of the American Locomotive Company, was born in 1882 at Kilmarnock, Scotland, where he attended the Kilmarnock Academy and the Science and Art College. After serving a special apprenticeship and working in various departments on the Glasgow & Southwestern, he was employed by Robert Stephenson & Sons, locomotive builders, Darlington, England, as a draftsman. In 1905 he went to the Montreal Locomotive Works, Ltd., Montreal, and served in several departments, becoming assistant superintendent, then superintendent of works, and finally works manager. In 1917 he was appointed manager of the munitions department of the Eddystone Munition Company. After the armistice he returned to England and was appointed general manager of the locomotive department of the Armstrong Whitworth Company, in charge of the building and equipping of the locomotive works and of the sales, engineering and manufacturing of locomotives. Later, he became also general manager of the pneumatic tool department, gas and oil engine department, and director of the Works Board of all the company's plants which included shipbuilding and the construction of Diesel oil engines for marine work, etc. He came to the New York office of the American Locomotive Company in January, 1922, and in the following June was appointed assistant manager of the Schenectady (N. Y.) plant. In January, 1925, he became manager of the plant, and in 1931 was elected president and director of the McIntosh & Seymour Corporation, Auburn, N. Y., a division of the American Locomotive Company. When the McIntosh & Seymour Corporation was merged with the parent company, Mr. McColl was named vice-president of the American Locomotive Company, Diesel Engine Division. In 1936 he was elected president of Alco Products, Inc., a division of the American Locomotive Company. With the merger of Alco Products, Inc., with the parent company, Mr. McColl became vice-president of the American Locomotive Company, Alco Products Division. Mr. McColl is a member of the Institute of Mechanical Engineers, London, England.

R. B. McColl

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William K. Breeze, district sales manager at New York, of the Jones & Laughlin Steel Corporation, Pittsburgh, Pa., has been appointed Pacific Coast manager with supervision over the district offices at Los Angeles, Cal., San Francisco, and Seattle, Wash., with headquarters in Los Angeles. John B. DeWolf, district sales manager at Philadelphia, Pa., has been appointed district sales manager at New York, and Herbert B. Spackman, assistant district sales manager at Philadelphia, has been appointed district sales manager at Philadelphia.

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Inland Steel Company.—Benton J. Willner and Maurice E. O'Brien have been appointed assistant vice-presidents of the Inland Steel Company, Chicago. Mr. Willner will assume the position of manager of sales of the Sheet and Strip Steel division, of which he has been assistant manager of sales since 1936. He was first affiliated with the steel industry when he joined the Inland Steel Company at its Indiana Harbor Works in 1927. Three years later he was transferred to the department of Inspection and Metallurgy at the Chicago office and became a member of the staff of

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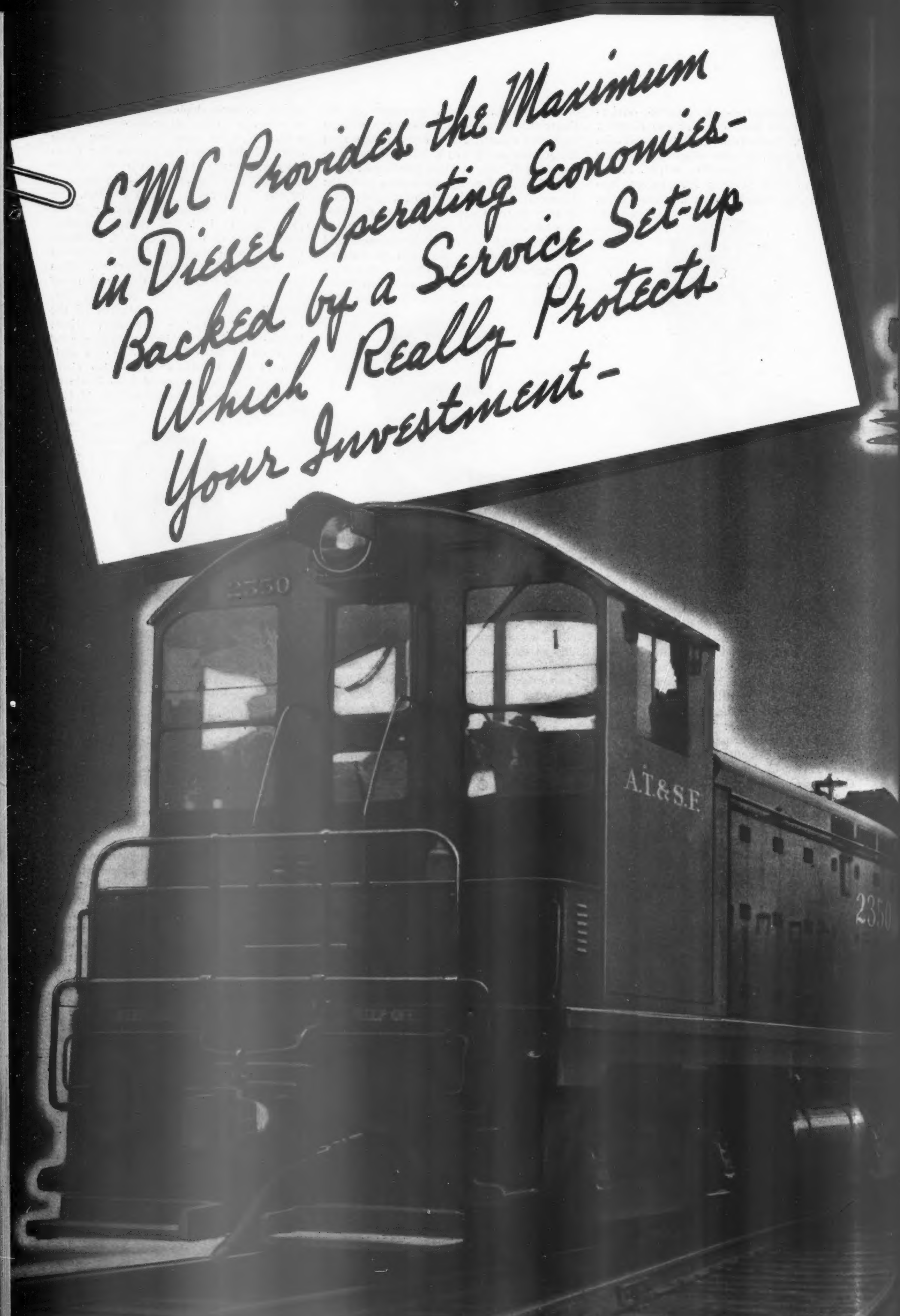
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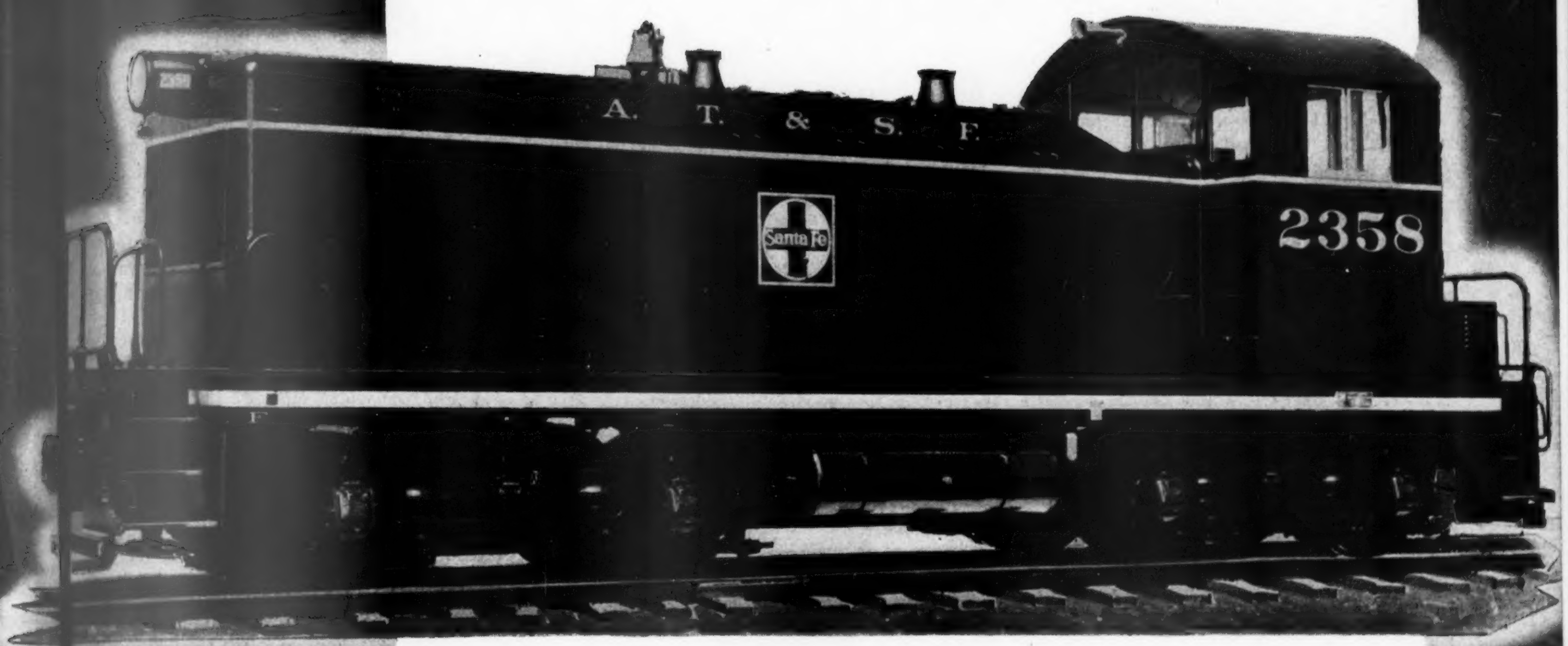

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ELECTRO-MOTIVE CORPORATION
SUBSIDIARY OF GENERAL MOTORS LA GRANGE, ILLINOIS, U. S. A.

the Sheet and Strip Steel sales division in 1931. Mr. O'Brien is manager of sales, carbon steel bars and billets, the position which he has held since 1936. He became affiliated with the Inland Steel Company's sales department in 1934, prior to which time he was associated with the Illinois Steel Company.

Obituary

Samuel Matthews Vauclain, chairman of the board of The Baldwin Locomotive Works since 1929 and associated with that organization since 1883, died of heart disease at his home in Rosemont, Pa., on February 4, at the age of 83, after a lingering illness. Mr. Vauclain was born in Philadelphia, Pa., on May 18, 1856. Shortly thereafter his father, who had been in the employ of Matthias W. Baldwin (founder of The Baldwin Locomotive Works) and of the Philadelphia & Reading, entered the service of the Pennsylvania and moved to Altoona, Pa., where the shops of that road were then under construction. The boy was educated at the Altoona public schools and at the age of 16 entered the employ of the Pennsylvania. At 21, his apprenticeship completed, he was made a foreman in the frame shop. In 1882, Mr. Vauclain was sent to The Baldwin Locomotive Works to inspect the construction of locomotives then being built for the Pennsylvania. As a result of this trip, he was offered a position with the Works and on July 1, 1883, entered their employ as superintendent of the Seventeenth Street Shops. In 1886, at the age of 30, he was made general superintendent of the plant, and in 1896 became a member of the firm of Burnham, Williams & Co., proprietors of the Works. In 1911, he was made vice-president of The Baldwin Locomotive Works, the company having been incorporated two years previously. He was appointed senior vice-president in 1917, and president in 1919. Ten years later, in 1929, Mr. Vauclain relinquished the presidency to George H. Houston and himself was elected chairman of the board, in which position he remained until his death. During the World War, Mr. Vauclain served as chairman of the Locomotive and Car Committee on the Council of National Defense, and also as chairman of the Special Advisory Committee on Plants and Munitions of the War Industries Board. It was during this period that he directed the supply of locomotives and munitions for participating countries and under his general direction a plant was built at Eddystone, Pa., for the manufacture of rifles. With the entrance of the United States into the World War, the entire facilities of The Baldwin Locomotive Works were placed at the disposal of the United States Government, and large orders for locomotives, ammunition and gunmounts filled.

For many years, Mr. Vauclain was a member of the board of a number of banks, insurance and civic organizations and at his death was a director of the Standard Steel Works Company, Baldwin-Southwark Corporation, Whitcomb Locomotive Company, I. P. Morris & DeLaVergne, Inc., The Federal Steel Foundry Company, Cramp Brass & Iron Foundries Co., and The Midvale Company, all Baldwin subsidiaries. He also served on the boards of the Westinghouse Electric & Manufacturing Co., and Westinghouse Electric International Company.

In view of services rendered to his own and foreign governments, Mr. Vauclain was awarded the Distinguished Service Medal by the United States government in 1919; the "Chevalier de la Legion d'Honneur Francaise" by France in 1919; "Il Cancelliere Dell' Ordine Della Corona D'Italia" by Italy in 1920, and the "Polonia Restituta" by the Polish government in 1923. He also received honorary degrees of Doctor of Science from the University of Pennsylvania and Worcester Polytechnic Institute and the degree of Doctor of Laws from Villanova College.

S. M. Vauclain

Mr. Vauclain had many talents but the foundation of his career was undoubtedly his uncanny ability as a machinist and practical engineer who knew steam locomotives and shop practice "from A to Izzard." Never given to theorizing or isolated study (he forewent college because after four years it would take too much time "to catch up with progress"), he was chiefly a "chalk-and-blackboard engineer" who carried the figures in his head and quoted bids on demand.

During his 57 years' association with Baldwin's, he had in some degree to do with the design and production of many "locomotives of the future." Among the successive innovations turned out during the Vauclain era were the first "decapod" heavy freight engine for the Dom Pedro II road of Brazil (1886); the first "wagon-top" boiler for the Denver & Rio Grande and the first "Mikado" for the Nippon railway named for the Japanese Mikado (1897). His best-known contribution to railroading as a technician was undoubtedly his four-cylinder compound locomotive, first tested in 1891. But probably more important to the industry were his tireless efforts to improve step by step the method and products of locomotive manufacture. Thus, shortly after becoming general superintendent of the Baldwin Locomotive Works at the age of 30, he installed the hydraulic forge for making drive-wheel centers, a device known abroad as a theory but unapplied. A few years later he decided to reduce idle time on expensive machine tools and introduced the double-shift to Baldwin's, an industrial principle now universal but unthought of in that day. He was even too progressive for inventors. George Westinghouse laughed at his friend Sam for suggesting that machine tools be operated as units by electric motors.

Samuel Vauclain not only made locomotives; he was one of their most successful merchandisers. This *modus operandi* was based on the belief that "a sale is not completed until the buyer is satisfied." He generally went along with new locomotives to make certain of their satisfactory operation. When times were dull, he either looked to foreign fields "where commercial skies were brighter" or pepped up the domestic market with new ideas. Thus he early extended the market for Philadelphia-built locomotives to wherever ties held rails apart. Success in these ventures depended first upon his ability to convince foreign operators—often untrained politicians—that they needed Baldwin locomotives and, second, upon his faith in their honesty and ability to pay. The Roumanians won't soon forget the deal he made with Queen Marie, "the country's best business man," by which he sold $15,000,000 worth of locomotives and machinery payable in 60 monthly installments in cash or oil. The oil he sold to the British government at a handsome profit. Typical of his tactics on the home front was the so-called "Prosperity Special," a consignment of 50 heavy freight locomotives (cost $5,000,000) which he had hauled as a solid train across the continent for delivery to the Southern Pacific during the depression of 1922.

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John B. Herman, sales engineer for the American Car and Foundry Company, at St. Louis, Mo., died on February 7.

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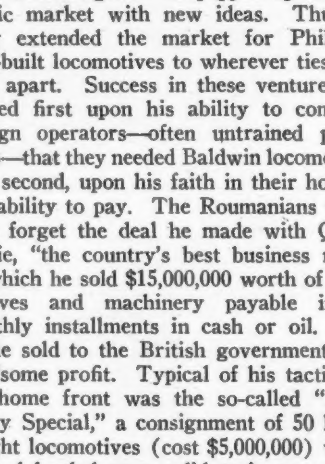
William E. Robertson, vice-president and manager of sales of W. H. Miner, Inc., Chicago, died on January 31. Mr. Robertson was born at St. Albans, Vt., on April 12, 1880, and was graduated from Norwich University, Northfield, Vt. He entered the employ of the Miner Company on March 18, 1910, as a draftsman and worked in the drafting and mechanical departments until March, 1911, when he was transferred to the sales department as a salesman. Later he engaged in executive sales work; in December, 1923, was elected a director and in March, 1927, became vice-president and sales manager.



William E. Robertson

Personal Mention

General

John Kennedy, superintendent and master mechanic of the McCloud River Railroad, with headquarters at McCloud, Calif., retired on January 1.

B. H. Smith, master mechanic of the Chicago, Rock Island & Pacific at Des Moines, Iowa, has been appointed superintendent of motive power of the Second district, with headquarters at Kansas City, Mo.

William Ferguson Connal, mechanical engineer of the Canadian National, with headquarters at Montreal, Que., has recently been appointed chief mechanical engineer, with jurisdiction over system matters. Mr. Connal was born on August 9, 1877, at Peterboro, Ont., and was graduated from McGill University at Montreal in 1897. He entered railway service on August 1, 1900, as special apprentice on the Lake Shore & Michigan Southern (now a part of the New York Central) and was a consulting engineer on that road from 1903 to 1904. From the latter date until 1905 he was employed by the Canadian Pacific at Montreal. In 1905 Mr. Connal became shop superintendent of the Damascus Brake Beam Company. He was employed by the New York Central & Hudson River (now part of the New York Central) from 1907 to 1908 and from 1908 to 1915 engaged in railway construction in Canada. From 1915 until 1919 he was employed by the Canadian Government (now the Canadian National) and in March, 1919, he was appointed mechanical engineer of the Canadian National, the position he held until his recent appointment as chief mechanical engineer.

William Ferguson Connal

Master Mechanics and Road Foremen

George Twist, division master mechanic of the Canadian Pacific at Nelson, B. C., has retired.

H. J. Reed, general foreman on the Canadian Pacific at Revelstoke, B. C., has been appointed to the position of division master mechanic at Nelson, B. C.

Car Department

Walter E. Dunham, superintendent of the car department of the Chicago & North Western and the Chicago, St. Paul, Minneapolis & Omaha, with headquarters at Chicago, who retired on February 1 as noted in the February issue, was born at Newark, N. J., on September 9, 1873, and graduated in mechanical engineering from Cornell University in 1895. He entered railway service in 1896 as a helper in the shops of the Chicago, Rock Island & Pacific at Horton, Kan., and in 1898, was advanced to the position of head draftsman in the motive power department at Chicago. Two years later, he was appointed master mechanic at Dalhart, Tex., and in 1902, entered the employ of the North Western as chief draftsman in the mechanical department at Chicago. Mr. Dunham became mechanical engineer in 1903 and in 1906 was appointed master mechanic at Winona, Minn. In 1910, he was promoted to supervisor of motive power and machinery with the same headquarters. He was appointed assistant to the general superintendent of the motive power and car department, with headquarters at Chicago in 1917, and from 1920 to 1921 served as a member of the railroad board of adjustment No. 2, returning to his former position in the latter year. He became superintendent of the car department in 1924, and in 1927 was appointed also superintendent of the car department of the Chicago, St. Paul, Minneapolis & Omaha. Mr. Dunham has long been active in the work of the Association of American Railroads, Mechanical division, having served as chairman of the committees on Train Lighting and Automotive Rolling Stock. He is a past president of the Western Railway Club, a former vice-president of the Car Department Officers' Association and is at present chairman of the Transportation group, Chicago section, of the American Society of Mechanical Engineers.

Walter E. Dunham

L. R. Wink, assistant superintendent of the car department of the Chicago & North Western, has been appointed superintendent of the car department, with headquarters as before at Chicago, succeeding Walter E. Dunham, retired. Mr. Wink was born on January 30, 1883, and entered railway service on August 1, 1899, as a car repairer at the Chicago shops of the North Western. In 1905, he was appointed special inspector at the Chicago shops and in 1908, was promoted to foreman at the Proviso Yards. He was transferred to the Wood street freight station at Chicago in 1909, and later that year was promoted to traveling car inspector, with headquarters at Chicago. Mr. Wink was advanced to general car foreman at the Chicago shops in 1915, and in September, 1919, was promoted to the position of assistant superintendent of the car department.

Obituary

Colonel James Milliken, former superintendent of motive power of the Philadelphia, Baltimore & Washington, part of the Pennsylvania System, died on February 5, at the McGirk sanatorium, Philipsburg, Pa. Colonel Milliken was born on February 19, 1865, at Newtown, Pa., and was educated at the University of Pennsylvania. He entered railway service on September 16, 1885, and served consecutively as a fireman on the Pittsburgh division of the Pennsylvania, machinist apprentice and machinist at the Altoona shops, and from January, 1890, to June, 1891, as assistant road foreman of engines on the Philadelphia division. He was then transferred to the Pittsburgh division and in February, 1892 was appointed assistant master mechanic at the Altoona shops. From August, 1895, to March, 1899, Colonel Milliken served as assistant engineer of motive power on the Philadelphia, Wilmington & Baltimore, now the Philadelphia, Baltimore & Washington, then to August, 1900, as assistant engineer of motive power on the United Railroads of New Jersey division and later, to January, 1903, as master mechanic at the Baltimore shops of the Northern Central. From June, 1903, to May, 1917, he was superintendent of motive power of the Philadelphia, Baltimore & Washington. All of the above service was with the Pennsylvania System. Colonel Milliken entered the United States War Department in May, 1917, and in October of the following year was appointed colonel of engineers. While in the army he was in charge of the design, procurement, and production of railroad equipment for the American armies in France and at the end of the war the French Republic conferred upon him the rank of Officer de la Legion d'Honneur, for distinguished service. In 1919, he served as president of the Industrial Car Manufacturers' Institute and subsequently became president of the Pittsburgh Testing Laboratories, remaining in that position until his retirement in 1929. Colonel Milliken became a member of the New York Railroad Club in October, 1895, and served as its president for the year 1917. During 1931, he was identified with Eastern Air Transport, Inc., at Brooklyn, N. Y., a division of the North American Aviation, Inc.

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